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ACTIVE RESEARCH TASKS REPORT

A COMPILATION OF DESCRIPTIVE SUMMARIES OF INTRAMURAL
AND EXTRAMURAL RESEARCH, DEVELOPMENT AND DEMONSTRATION
TASKS

NATIONAL ENVIRONMENTAL RESEARCH CENTER

1973

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ACTIVE RESEARCH TASKS REPORT

FISCAL YEAR 1973



**NATIONAL ENVIRONMENTAL
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**NATIONAL ENVIRONMENTAL RESEARCH CENTER
Cincinnati, Ohio**

**A COMPILATION OF DESCRIPTIVE SUMMARIES
OF INTRAMURAL AND EXTRAMURAL RESEARCH, DEVELOPMENT
AND DEMONSTRATION TASKS**

July 1, 1972—June 30, 1973

Compiled and Edited by:

George R. Shultz

Doris J. Harmon

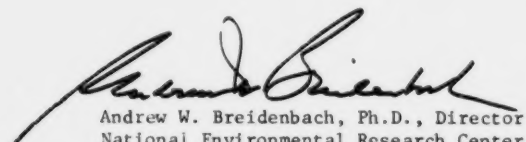
**U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH & DEVELOPMENT
NATIONAL ENVIRONMENTAL RESEARCH CENTER
Cincinnati, Ohio 45268
1973**

FOREWORD

A primary mission of the National Environmental Research Center, Cincinnati, is to find means to protect, preserve, and maintain the environment in which we live. In doing this it is necessary to provide a focus for coordinated developmental research, which accents the interplay of the various sections of our total physical environment...air, water, and land. The major theme of NERC-Cincinnati is the development of environmental protection technology.

Many contract, grant, and in-house research projects are supported by the Office of Research & Development at the Center. The need is obvious for compiling and disseminating the information on these projects.

This publication of the National Environmental Research Center, Cincinnati, entitled "Active Research Tasks Report," is a document that will promote rapport between individuals. It should also provide a better understanding of what is being undertaken at the Center and stimulate communication and the exchange of ideas.



Andrew W. Breidenbach, Ph.D., Director
National Environmental Research Center
Cincinnati, Ohio

PREFACE

The major theme of the Center's research activity is the development of technology and processes for the control of pollutants that degrade our air, water, and land environment. Programs that directly reflect this major theme include: the development of advanced methods for the treatment and control of municipal wastewater streams, in conjunction with the control of pollution resulting from storm and combined sewer overflows; the development of solutions to various specialized water pollution control problems such as oil and hazardous material spills, watercraft wastes, industrial wastes, mine drainage, and recreational wastes; the development or improvement of contaminant removal processes for the purification of the Nation's water supplies and recreational waters; the development of processes for environmentally acceptable treatment of toxic and hazardous solid waste materials; the development of resource recovery systems for the management of municipal and industrial solid waste; and the development of improved methods for the processing and disposal of these solid wastes.

Other programs at the Center, such as the assurance of monitoring quality, directly complement the above technology development programs. They also provide input to the Environmental Protection Agency (EPA) enforcement and standards-setting missions. Representative of these complementary research programs are: the development, refinement and promulgation of improved analytical methods for the measurement and determination of water quality (this activity is unique within EPA and serves as EPA's principal focus for the development of water quality measurement procedures); the quantification and analysis of radioactive discharges at existing nuclear power stations and associated facilities, which leads to the development or improvement of appropriate radiochemical analytical methods and the establishment of guidelines for appropriate radiological monitoring system.

The role of the Center's supportive research is to provide strong input to EPA's overall missions and goals, and to provide research relevant to the Agency's overall integrated research program. The toxicological and virological competence at the Center is well known, and is essentially unique within the Agency. Programs indicative of this supportive-type research include: the development of valid criteria for setting water quality standards for drinking water supplies, municipal sewage treatment plant effluents, sanitary landfill leachates, and recreational waters (this activity, encompassing toxicological and virological assessments, has a vital role to play in determining the feasibility of various water reuse possibilities); and, the detection and definition of the harmful effects of environmental pollutants on living systems, in support of the development of air quality criteria and standards.

Because of the existence of closely-related major and supportive research themes at the Center, problems are addressed through a fully-integrated, multi-media, multi-disciplinary "total environment" approach. Water pollution and solid waste management technology developers, for example, work closely together utilizing an integrated, total systems approach to insure that the pollutants removed from a water stream are "disposed of" appropriately, whether it be through material reuse, non-air-polluting incineration or pyrolysis, or through non-water-polluting sanitary landfilling. Also, technology development researchers, together with supportive researchers, can readily determine to what extent their engineered systems must perform and what standards must be met. They can readily determine the health and environmental implications of poorly functioning technological systems, and what it costs to increase their demonstration pollution abatement plants and systems to higher and higher efficiencies. Finally, they are able to weigh these costs against public health and environmental gains.

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INTRODUCTION

This report has been compiled in order to disseminate a total picture of the research programs conducted and supported by the National Environmental Research Center, Cincinnati, during Fiscal Year 1973.

The report is organized according to major research program elements, subdivided according to the Center's research objective achievement plans, and with each research objective achievement plan further subdivided into individual research tasks (or projects).

The reader is reminded that research planning, as well as achievement of research results, is a dynamic and sometimes rapidly changing process which leads to program redirection; therefore, this report represents the current research program at the Center at the time of the report's formative stage, namely May-June 1973.

Some of the research tasks described in this report were initiated by EPA's predecessor organizations and in order to provide a written continuity for purposes of this report, these tasks have been "fitted" into current research program elements and research objective achievement plans.

This report reflects the closely related major and supportive research themes at the Center as they are being coordinated for a "total environment" approach. It is believed that the information contained in the pages that follow, will be of benefit to all users.

George R. Shultz

BIOMEDICAL RESEARCH

1A1007

OUTPUT: Generation of health effects information required for development and revision of criteria and standards pertaining to air pollutants. Program effort includes: (1) studies of pollutants acting singly or in combination with other pollutants or environmental factors; (2) assessment of pollutant effects upon accidental exposure victims, human volunteers, laboratory animals, isolated perfused organ systems and tissue cultures; (3) demonstration of possible adverse effects caused by carbon monoxide, odors, certain trace substances and acid mists; and (4) development of laboratory models to predict the impact of environmental pollution upon biological systems.

FUEL AND FUEL ADDITIVE HEALTH EFFECTS RESEARCH

RESEARCH TASK/PROJECT TITLE Comparative Toxicologic Evaluation of Emissions from Fuel Combustion			FY 1973 TASK NUMBER 21AFK 01
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF FEPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Jerry F. Stara, Director Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$491,700

TASK/PROJECT DESCRIPTION AND REPORTS

Objectives include determination of relative toxic potential of emissions resulting from use of various fuels, fuel additives, and control devices in automotive, diesel and aviation mobile sources and in stationary fuel combustion systems. The test data are used in process of criteria development which are used for setting the environmental pollution standards; and in the process of development of standardized toxicologic test protocols.

Serial experiments involving exposure to selected biological models *in vivo* and *in vitro* to raw and irradiated whole emissions or components thereof generated by combustion process using chemico-physical characterization of emissions (gaseous and particulate components) and multidisciplinary quantitation of associated biological effects are conducted.

In 1972, this approach has been used for the comparative evaluation of emissions and bioeffects resulting from the use of reference fuel with and without a test additive. In FY '73, studies will be conducted on diesel fuel, further gasoline and additives testing and the incorporation of emission control devices (catalytic converter) using improved facilities and systems. Essential task elements of the project include supportive aerometry (atmosphere monitoring and characterization); engineering (operation, exhaust generation, dilution, delivery, and control systems); and multidisciplinary biological testing approach including biochemical, pathological and physiological investigations.

RESEARCH TASK/PROJECT TITLE Assess Biochemical Changes Following Laboratory Animal Exposure to Fuel Emissions and/or Trace Metals			FY 1973 TASK NUMBER 21AFK 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF FEPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER S. D. Lee, Supv. Res. Chemist Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$98,300

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this investigation is to identify and assess early biochemical changes in animals exposed to individual pollutants such as trace metals, and emissions from automotive, diesel, aviation and stationary fuel combustion systems. The biochemical studies include the measurement of various enzyme activities and profiles, oxidative metabolism of subcellular organelles and oxidative alteration of tissue components; e.g., polyunsaturated fatty acids.

Hamsters are exposed to auto emissions under four different exposure conditions; biochemical parameters such as blood glutathione, leucineaminopeptidase, lactic dehydrogenase, glucose-6-phosphate dehydrogenase, fatty acid composition of lung lavage, and aryl hydrocarbon hydroxylase are examined.

Biochemical effects which have been observed include the following: Oxidative destruction of fatty acids, placed on film exposed to fuel emissions. Fatty acid composition of lung lavages and blood glutathione levels changed slightly with exposure. Hamster lung aryl hydrocarbon hydroxylase activity decreased after 5 days and 13 days of exposure to fuel emissions. Intragastric administration of CH_3HgCl (0.05 & 0.1 mg/kg, B.W.) caused suppression in $^{14}\text{CO}_2$ output following injection of ^{14}C -1-glucose. This effect was cumulative when treatment was repeated one week later. This alteration is one of the earliest effects observed after exposure to such low concentrations of methylmercury chloride.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Behavioral Effects Following Exposure to Fuels and Fuel Additives			21AFK 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Michael I. Gage, Res. Psychologist Environmental Toxicology Research Lab, NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$73,700

TASK / PROJECT DESCRIPTION AND REPORTS

Several species of animals (monkeys, hamster, rats, mice) are being examined for alterations in behavior during and after exposure to emissions from combusted fuels and fuel component substances including trace metals (manganese, lead, etc.). Specific measurements including learning and memory, patterns of schedule controlled operant behavior, locomotor activity, food and water intake, and aggressive behavior. Initial results indicate automotive fuel exhaust emissions suppress voluntary running of mice in activity wheels and under some conditions suppress water licking of rats. Exhaust of fuel with a methyl cyclopentadienyl manganese tricarbonyl additive produces activity wheel behavioral suppression similar to that produced by exhaust of fuel with no additives in short-term exposure studies.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Assessment of Pulmonary, Cardiovascular and Renal Function Following Exposure to Environmental Pollutants - A. Fuel Emissions			21AFK 04(a)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Mildred J. Wiester, Res. Physiologist, Environmental Toxicology Res. Lab, NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$50,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to measure and assess various cardiovascular and pulmonary responses following exposure to fuel emissions. The ultimate goal is to gain information that might differentiate relative degrees of toxicity encountered when selected fuel additives are mixed with the fuel. Male rats are exposed continuously for 1-2 weeks to graduated concentrations of emissions from mobile sources. Arterial blood is drawn from catheterized unanesthetized animals under the influence of the atmosphere. Animal weights and body temperatures are noted. Hematology, blood gases, pH and carboxyhemoglobin are measured.

The biologically inert and insoluble challenge aerosol, titanium dioxide, is used to assess the pulmonary cleansing mechanisms (phagocytosis and mucociliary transport) for the removal of inhaled sparingly soluble particulates following exposure to fuel and fuel additive combustion products.

RESEARCH TASK / PROJECT TITLE Assessment of Pulmonary, Cardiovascular and Renal Function Following Exposure to Environmental Pollutants - B. Trace Metals			FY 1973 TASK NUMBER 21 AFK 04(b)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Mildred J. Wiester, Res. Physiologist Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$23,700

TASK / PROJECT DESCRIPTION AND REPORTS

The toxicity of cadmium has been established, especially as it relates to high industrial exposures. However, health effects of lesser "environmental" levels must be further defined. The objectives of this investigation are to determine effects of chronic cadmium ingestion on blood pressure and renal function in monkeys. Completion of the planned series of experiments should yield information on: (1) cadmium dose-time hypertensive effect in primates; (2) cadmium-time-change in proximal tubular function in primates; (3) relationship between cadmium induced hypertension and proximal tubular damage; and (4) cardiovascular and renal changes relative to tissue cadmium levels in primates.

Blood pressure is measured under unanesthetized conditions using a non-invasive method. Twenty-four urine samples are analyzed for amino acids, calcium excretion, and standard urinalysis. Renal function tests, GFR, RPF, and TmPAH are performed before cadmium ingestion and subsequent to a pressor effect or changes in urine components are found.

Progress to this time includes development of all necessary procedures and methodology. A pilot study is underway to estimate the optimal dose-time-effect for monkeys.

RESEARCH TASK / PROJECT TITLE Toxicity of Potentially Hazardous Substances - A. Metabolism and Kinetics			FY 1973 TASK NUMBER 21AFK 05(a)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Wellington Moore, Jr., Deputy Director Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$127,500

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this task are to determine percent absorption, distribution, critical organs, total body burden, modes of excretion and comparative toxicity of potentially hazardous trace substances, especially trace metals in animal test systems exposed by routes and at levels relevant to environmental exposure. The hazardous trace substances of major concern are those associated with auto pollution. Animals are exposed in environmental chambers to these substances (using radioactive tracers, if available), sacrificed at prescribed intervals of time and tissues taken for histopathology and chemical analysis. Substances under current study include Pb, Cd, Hg, and 2-methylcyclopentadienyl manganese tricarbonyl. Special emphasis is placed on age sensitivity effects, usage of chemical compounds present in the environment and various routes of administration relative to exposures by air, water, and dietary media. Reports on some of the studies have been submitted to open literature for publication.

RESEARCH TASK/PROJECT TITLE Toxicity of Potentially Hazardous Substances - B. Neurophysiological Determination of the Central Nervous System Effects			FY 1973 TASK NUMBER 21AFK 05(b)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James P. Lewkowski, Res. Physiologist Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$20,000

TASK/PROJECT DESCRIPTION AND REPORTS

The effects of various pollutants on the visual evoked potential is being tested. Initial studies will determine if the intravenous administration of low levels of cations such as Mn, Cd, Hg, elicit any change in the computer-averaged visual evoked potential. If results are positive, then chronic experiments will be undertaken in which the pollutant or cation will be administered by inhalation.

The work on the visual evoked potential will be correlated with spinal cord studies. The effects of various toxicological agents on the spinal cord will be determined through the use of isolated reflex arcs. Since many of the transmitter agents in these reflex arcs are now known, then the effects of various toxicological agents on the release of particular transmitter agents may be elucidated.

Thus, both the general and specific effects of various toxicological agents on the central nervous system will be determined. Initial studies in both systems will include trace metals which will be used as fuel additives and in catalytic converter systems. Later, experiments will include other potentially hazardous trace metals and pollutants.

RESEARCH TASK/PROJECT TITLE Micropathologic, Histochemical and Cytodynamic Evaluation of Tissues from Animals Exposed to Fuel Emissions			FY 1973 TASK NUMBER 21 AFK 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER David K. Hysell, Vet. Pathologist Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$49,200

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this task is to evaluate the effects in animals of exposure to fuel combustion emissions and emission compounds utilizing micropathologic, histochemical and cytodynamic techniques. Fuels used consist of a reference fuel and a reference fuel plus additives of major interest. During and following exposure, animals are sacrificed and tissues taken for micropathologic or histochemical analysis. Another set of studies concerns individual pollutants especially trace metals such as Pb, Hg, and Cd. In addition, some animals are given labeled precursors to determine the effect of exposure upon the incorporation of these substances into cells. Current studies involve the determination of biological effects following short-term exposures to indolene (reference fuel) and indolene containing 2-methylcytopentadienyl manganese.

RESEARCH TASK/PROJECT TITLE Potential Hazards of Exposure to Fuel Combustion Emissions in Animal Model Systems with Respect to Reproductive Function			FY1973 TASK NUMBER 21AFK 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Wellington Moore, Jr., Deputy Director Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$49,200

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this task is to assess the potential biological hazards of exposure to fuel combustion emissions and selected emission components including trace metals, in experimental animal models, with respect to reproductive function including male/female and offspring fertility, embryonic development, and offspring survival.

Animals in early stages of pregnancy are exposed in chambers to irradiated and non-irradiated exhausts from automotive and diesel engines. Prior to the end of gestation, some of the pregnant females are sacrificed and the fetuses examined for presence of teratological changes. The offsprings from the remaining pregnant animals are checked for size, weight, and for various other parameters of growth and development. In other groups of animals, the pregnant females are exposed to radioactive labeled fuel additives and maternal and fetal uptake and distribution determined.

RESEARCH TASK/PROJECT TITLE Fuel and Fuel Additive Health Effects Research - Design and Fabrication of Equipment			FY1973 TASK NUMBER 21AFK 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert G. Hinners, Supv. Res. Mech. Engr. Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/73	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Included in Federal Cost: Tasks 01-07

TASK/PROJECT DESCRIPTION AND REPORTS

Provide and operate an exhaust generating and animal exposure system, required by the laboratory for assessing the relative health hazard of emissions resulting from the combustion of fuel and additives in various mobile sources.

The generating system has recently been modified to provide air cooling of the raw exhaust gas before irradiation, to reduce loss of particulates.

The laboratory has obtained a 1975 Ford 400 C.I.D. proto-type engine with a monolithic catalytic converter unit. The Ford engine will replace one of the existing 1972 Chevrolet 350 C.I.D. engines, presently in use on a 60 day MMT additive experiment. A durability test using an unleaded gasoline will be conducted to provide characterization of the emissions and determine toxicological effects of the gaseous and particulate (trace metal) emissions, resulting from degradation of the catalytic converter. After the Ford test has been completed, a 1975 Chevrolet proto-type engine with a GM oxidizing catalytic converter will be installed and a similar experiment conducted. It is intended to run each study for 50,000 miles or until failure of the catalyst, whichever occurs first.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Analytical Chemistry of Atmospheric Pollutants in Animal Exposure Studies			21AFK 09	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER M. Malanchuk, Research Chem. Engineer Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Included in Federal Cost: Tasks 01-07	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives involve the development and evaluation of atmospheric measurement used in the generation of aerosols and gaseous atmospheres for animal studies on the effects of inhalation exposure to potentially hazardous substances including trace metals and emissions from mobile and other fossil fuel combustion sources.

Generation and monitoring of the exposure varies with the type of material and purpose of the study and thus requires development or adaptation of methods and instruments used in the sampling and analysis of gases, vapors, and particulate material. Animal tissue and body fluids are analyzed to determine as needed for the analysis of animal tissues and body fluids taken from exposed animals.

Sampling systems and analytical procedures are constantly being improved to provide accurate data on concentrations of the toxic agents to which the test animals are exposed and which they have absorbed into the body.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Highly Active Binders of Metal Pollutants			21AFK 21	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Stanley C. Skoryna, Gastrointestinal Res. Laboratory McGill University P.O. Box 6070, Montreal 101, Quebec, Canada			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Jerry F. Stara Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	6/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$29,940	

TASK/PROJECT DESCRIPTION AND REPORTS

Preventive measures are sought which would diminish potential public health hazards of metals presently used and those the use of which, is expected to increase. The overall objective is to diminish or nullify environmental hazards associated with metal usage, by means of metal ion exchange reaction. The current work is carried out on cadmium, manganese, and lead. Methodology: (1) extraction and isolation of metal binding polymers; (2) in vitro studies of binding capacities and binding stability in presence of other metals; and (3) studies of the morphological characteristics of metal macromolecular complexes and interpretation of the reactions in terms of stereo chemistry.

RESEARCH TASK/PROJECT TITLE Effects of Lead and Mercury on Synaptic Transmission in the Cat Spinal Cord			FY 1973 TASK NUMBER 21AFK 22	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR G. P. Cooper, Department of Environmental Health University of Cincinnati Cincinnati, Ohio 45219			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Mildred J. Wiester, Res. Physiologist Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/1/73	EST. COMP. DATE 1/1/76	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$10,000

TASK/PROJECT DESCRIPTION AND REPORTS

The main goals of these experiments are: (1) to determine whether inorganic lead or mercury ions have any effect on either excitatory or inhibitory reflex activity in the cat spinal cord, in experiments involving the stimulation of and recording from spinal roots and muscle nerves and, subsequently; (2) to more clearly define the site and mode of action of lead and mercury through experiments in which intracellular microelectrodes are used to examine synaptic transmission and membrane electrical properties in single spinal cord neurons.

Decerebrate, curarized cats will be used in all experiments. Solutions of lead chloride or mercuric chloride will be injected, in microliter quantities, directly into the ventral horn of the spinal cord through multiple-barrel pipettes. In Phase I of these experiments spinal reflex transmission, as studied in spinal roots and muscle nerves, will be examined before and after the injection of lead chloride and mercuric chloride. Phase II will consist of experiments in which intracellular micro-electrode recordings from anterior horn cells are used to determine whether lead or mercury ions affect the amplitudes of excitatory or inhibitory postsynaptic potentials, or the membrane potential or effective input impedance of anterior horn cells.

RESEARCH TASK/PROJECT TITLE Stereoelectron and Electron Microscopic Study of Lungs from Female Beagle Dogs Chronically Exposed to Auto Exhaust and Other Pollutants			FY 1973 TASK NUMBER 21AFK 23	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert J. Stephens, Stanford Research Institute 33 Ravenswood Avenue Menlo Park, California 94025			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER David K. Hysell, Vet. Pathologist Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/31/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$18,000 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of the study is to examine, at both the light and electron microscopic levels, pulmonary tissue from beagle dogs chronically exposed for 5 years to automobile exhaust and other selected atmospheric pollutants. An effort is made to ascertain morphologic changes which might be the result of these chronic exposures. Biopsy specimens of lung tissue from 15 beagle dogs chronically exposed to auto exhaust were taken by lobectomy and prepared for observation using recognized techniques. Plastic embedded tissue is thin sectioned and stained with uranyl acetate and lead citrate for examination by electron microscopy. It is currently planned that the final evaluation will be completed prior to June 1973.

RESEARCH TASK/PROJECT TITLE Lead: Placental Transfer, Central Nervous System Effects, and Immune Response Alterations			FY 1973 TASK NUMBER 21AFK 26
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William B. Buck, Iowa State University Department of Science and Technology Ames, Iowa 50010		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Jerry F. Stara, Director Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$31,976 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this study are to investigate the placental transfer of lead to characterize the neurophysiological and behavioral effects of lead exposure in the young lambs. In addition, the effects of lead on the immune response mechanism are being determined. The placental lead transfer is evaluated by determining the amount of lead transferred to the fetus following exposure of the dam and by comparing this data with data received from experiments in which rats were exposed in an analogous fashion. The central nervous system effects are ascertained through the use of modified HEBB-Williams maze which tests both learning and problem solving ability and through visual discrimination tests. The data received from the immune response system will determine the effect of lead exposure on the serum immune proteins of young sheep as well as the effect of lead exposure upon the immune response to bacterial antigens.

GASEOUS AIR POLLUTANTS

RESEARCH TASK / PROJECT TITLE Maintenance and Observation of Chronic Study of the Effects of Auto Exhaust and Other Pollutants in Female Beagles		FY 1973 TASK NUMBER 21AFL 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR D. L. Dungworth, Director of Pathology Office of the Dean, Research and Development University of California, Davis, California 95616		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Jerry F. Stara, Director Environmental Toxicology Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/71	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$60,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this study is to evaluate the health effects of long-term exposure to automobile exhaust and other pollutants in 104 female beagle dogs. The dogs have been exposed for five years in chambers where carefully monitored amounts of raw automobile exhaust, simulated smog, sulfur oxides, nitrogen oxides and their combinations, were present. Subsequently, the animals have been maintained for 1-1/2 years in an ambient environment. At regular intervals throughout the study the animals have undergone a thorough testing regimen for various bioeffect parameters such as hematologic, radiographic, cardiovascular, pulmonary, CHS, and clinical. Histopathologic examinations of tissues were performed on animals who died accidentally during the study period and on lung biopsies from selected animals. Results thus far indicate possible chronic cardiovascular and pulmonary effects. Clinically the animals showed a higher incidence of dermatitis and epiphora during the exposure.

METHODS DEVELOPMENT FOR IDENTIFICATION OF POLLUTANTS 1B1027

OUTPUT: Physical, chemical, and biological methods for detection, identification, and measurement of water pollutants. Program efforts will be to: (1) develop sensors and methods that will indicate the presence of pollutants and measure their quantity down to required levels, rapidly and continuously; (2) develop the necessary instrumentation to utilize these sensors and methods to identify, measure, and trace pollutants automatically and economically, both in-situ and by remote sensing; (3) develop statistical testing plans to enable rapid screening of water for pollutants with a minimum number of samples; and (4) develop mathematical models that predict the sources of a pollutant from the information obtained in downstream testing.

DEVELOPMENT OF RAPID METHODS FOR THE DETECTION AND ENUMERATION OF
PATHOGENIC BACTERIA IN DRINKING, RECREATIONAL, AND OTHER WATERS

RESEARCH TASK/PROJECT TITLE Investigation and Evaluation of Cultural, Biochemical and Serological Methods for Salmonella			FY 1973 TASK NUMBER 05AED 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/73	EST. COMP. DATE 12/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

A series of cultural, biochemical, and serological tests which are tedious and time-consuming, are required to fully identify enteric pathogens such as Salmonella. The objective is an abbreviated generally acceptable test series which will identify these microorganisms and can be recommended as guideline procedures for use with organisms isolated from water. Commercially-available diagnostic kits and multi-test systems for the rapid identification of Enterobacteriaceae will be evaluated for use as screening tests. Serological confirmation and periodic confirmation of species identification by state health laboratories or CDC will be included. Cultures recently isolated from water and known stock cultures will be included in the evaluation.

RESEARCH TASK/PROJECT TITLE Evaluation of Qualitative and Quantitative Procedures for Salmonella in Water			FY 1973 TASK NUMBER 05AED 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/72	EST. COMP. DATE 4/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$20,000	

TASK/PROJECT DESCRIPTION AND REPORTS

A wide variety of microbiological procedures for the isolation and identification of enteric pathogens have been reported, particularly in recent years. Most of these methods and media were proposed for environmental sources other than water, many of them for clinical specimens. Few of the methods were quantitative. The objectives of this current research are to develop, apply and evaluate new or improved procedures for the rapid detection of Salmonella in water. These investigations will include sampling and field techniques, enrichment and selective plating media. The time and temperature of incubation procedures for growth will receive special attention. Enrichment procedures will be modified. There is a particular interest in the enumeration of these enteric pathogens; proposed Most Probable Number and other semi-quantitative techniques will be evaluated. To-date a detailed evaluation of three enrichment and four plating media commonly used has been carried out using natural water samples from the local geographical area. The enrichment media in order of decreasing selectivity were dulcitol selenite broth, tetrathionate-brilliant green broth and Rappaport's medium. The plating media in order of decreasing selectivity were brilliant green, Hektoen enteric, xylose-lysine-desoxycholate and MacConkey's agar. A secondary enrichment technique proved useful for tetrathionate broth only. Additional enrichment media are being evaluated for the isolation of these organisms from water.

RESEARCH TASK / PROJECT TITLE Development of a Fluorescent Antibody Technique for the Identification of Enteropathogenic <u>E. coli</u> from water			FY 1973 TASK NUMBER 05AED 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NEI - Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 6/74	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$20,000

TASK / PROJECT DESCRIPTION AND REPORTS

The fluorescent antibody technique has frequently been reported to be a promising technique for the rapid detection of specific organisms or groups of organisms from various sources. This research project plans to investigate and evaluate the technique for indicator and pathogenic organisms in water. The initial group selected for investigation is the enteropathogenic E. coli because commercially prepared antisera are already available. In addition to specific identification, enumeration methods will be studied. The approach will include both cells and mini-colonies after minimal growth periods. Sampling, concentration of samples, incubation, and staining procedures will be included.

The FA equipment and supplies have been acquired, set up and checked out in the laboratory. Initial tests have been run with known cultures. Two investigators have received specialized training in the technique.

RESEARCH TASK / PROJECT TITLE Development of Reversed Phage Technique			FY 1973 TASK NUMBER 05AED 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard K. Miller Fairfax County Health Department Fairfax, Virginia		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/73	EST. COMP. DATE 7/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$40,000

TASK / PROJECT DESCRIPTION AND REPORTS

The need for rapid methods for the identification of Salmonella and other pathogens is critical enough to warrant the pursuit of more than one promising approach. This research grant proposal is a feasibility study of a rapid and sensitive screening method developed by the Atlantic Research Corporation for the detection of enteric pathogens by testing for the presence of bacteriophages capable of lysing them. Samples seeded with a panel of representative pathogens are plated and observed for plaque formation caused by homologous phages present in water. The study would be carried out on polluted streams receiving treated and untreated industrial and domestic wastes as well as relatively clean streams in Fairfax County. The technique requires six hours but is limited to the number of cultures included in the test panel and their homologous phages. Therefore, the technique may be applicable to certain water samples or effluents where the presence of selected pathogens is of importance. The reversed phage titre procedure proposed offers a possible rapid screening test for pathogens in water after careful investigation of: (1) its limits of specificity and selectivity; (2) the effect of industrial wastes, disinfection and other waste treatment procedures upon phage; and (3) technical difficulties such as false plaques or the obscuring of plaque formation by confluent bacterial growth. Problems in interpretation of results will include the viability of the bacteriophage in water, recency of the pollution, the baseline values for bacteriophage, and the possibility that enteric pathogens may be present without their homologous phage or, conversely, that the phage may occur naturally in the absence of the host bacteria.

METHODS FOR DETERMINING BIOLOGICAL PARAMETERS OF ALL WATERS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Prepare Methods Manual for Field & Laboratory Studies of Aquatic Organisms			05AEF 01
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER	
		Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/70	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$20,000

TASK/PROJECT DESCRIPTION AND REPORTS

A national committee of senior EPA biologists will screen, select, and describe methodology to be incorporated into a unified manual describing techniques for the collection and analysis of plankton, periphyton, macrophyton, macroinvertebrates, and fish. The methods will be compiled, edited, and printed by the staff of the Biological Methods Activity, Analytical Quality Control Laboratory. The manual will be revised periodically as required to keep it current.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Develop Methods of Collecting Aquatic Organisms			05AEF 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER	
		Cornelius I. Weber Analytical Quality Control Laboratory NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/69	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$28,500

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop sampling methods to determine the biological effects of effluents, detect violations of water quality standards, evaluate the trophic status of waters, and carry out effective long-term water quality monitoring programs. Problems considered include: (a) sampling frequency; (b) replication and precision; (c) comparison or evaluation of the performance of sampling devices such as grabs and nets; (d) studies of the effects of substrate composition and texture, and the depth and length of exposure of artificial substrates on the quantity and species composition of periphyton and macroinvertebrates which colonize the samplers. Portable devices for measurement of field conditions such as current velocity, light, and temperature are also developed and/or evaluated. Standardized and validated methods developed in this project will be included in the Agency Biological Methods Manual.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Develop Portable Solid-State Water Current Meter			05AEF 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Frank A. Kelleher Marsh-McBirney Company Rockville, Maryland			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$13,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop a lightweight, inexpensive, portable electronic water current meter, to be used in checking current velocity when sampling aquatic organisms during studies of the effects of pollution on aquatic life. The instrument is to be equipped with a solid-state electromagnetic current sensor housed in a probe approximately 3/8" x 6". The instrument case shall be approximately 4" x 8" x 4", with a 4" panel meter calibrated in meters per second. The instrument shall have two operating ranges: 0 - 1 meter per second, and 0 - 3 meters per second, and shall be provided with a shoulder strap for ease in carrying in the field. The instrument shall be designed with the intent that it be marketed at a price of \$400 - \$500.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Develop Methods of Processing Samples of Aquatic Organisms			05AEF 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/69	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$22,500	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop and evaluate techniques of preserving, staining, sorting, and counting aquatic organisms in samples collected in field studies. Preservative properties that will be examined include their stability, odor, and hazards involved in their use, and their ability to maintain the physical integrity, color, and other features necessary for identification of the specimens. Stains, mechanical sorting devices, and sample splitting techniques will be studied to determine their efficacy in reducing the time required to sort the organisms from debris, and otherwise process the sample. Sample counting techniques to be investigated include the use of automatic optical and electronic devices and computerized particle counting and sizing instruments. Methods found suitable for Agency-wide application will be included in the Biological Methods Manual.

RESEARCH TASK / PROJECT TITLE Develop Methods of Identifying Aquatic Organisms			FY 1973 TASK NUMBER 05AEF 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/69	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$16,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to provide techniques for the rapid and detailed identification of aquatic organisms by field personnel. Project activities include: (a) the consolidation of widely published taxonomic descriptions into laboratory guides for the identification of common aquatic organisms; (b) development of techniques for rearing larval forms to maturity to obtain information on life cycles which is essential for identification; (c) evaluation of the usefulness of new types of photo and electron microscopy, such as phase interference (Nomarski optics) and transmission and scanning electron microscopy, in solving identification problems; and (d) development of identification techniques using karyosystematics, electrophoresis and gas chromatography. Methods found suitable for Agency-wide application will be included in the Biological Methods Manual.

RESEARCH TASK / PROJECT TITLE Develop Methods of Measuring Biomass and Metabolic Rates of Aquatic Organisms			FY 1973 TASK NUMBER 05AEF 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/69	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$44,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop and/or evaluate methods of measuring biomass and biological activity. Project activities include the study of techniques for determining dry weight, ash-free weight, DNA, ATP, chlorophyll, organic carbon, caloric content and other parameters related to standing crops, and the measurement of rates of metabolic activity such as respiration, electron transport, photosynthesis, nitrogen fixation, and processes such as energy flow through the food web and biological control mechanisms. Methods found suitable for Agency-wide application will be included in the Biological Methods Manual.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Develop New Methods for Measuring Chlorophyll			05AEF 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. Douglas Winget, Department of Biological Sciences University of Cincinnati Cincinnati, Ohio 45219		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	6/30/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

New methods for the identification and quantification of algal pigments will be investigated, including thin-layer, liquid and pyrolysis gas chromatography.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Evaluate Static and Flow-through Bioassay Methods			05AEF 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop and/or evaluate methods for: (a) acute and chronic laboratory bioassays for toxic substances, industrial and domestic wastes, and surface waters; (b) long-term or continuous field or in-plant monitoring of surface waters and effluents; and (c) tracing the movement and accumulation of hazardous materials in the aquatic food chain. Methods which will be studied include static (jar) and flow-through techniques for use in stationary and mobile (land or water-based) laboratories, with response levels ranging from low-threshold physiological and/or behavioral response to mortality (TLM).

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Develop Water Quality Requirement Profiles for Indicator Species			05AEF 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Rex L. Lowe, Biology Department Bowling Greene State University Bowling Greene, Ohio		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	Continuing	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

Published information on the geographical distribution, seasonal occurrence, water quality requirements and pollution tolerance of common species of aquatic organisms will be compiled and summarized to identify "indicator species" that will be of use to Federal and state pollution biologists in interpreting data collected in field studies. Information on the environmental requirements will be organized in a standard format and machined for storage in the EPA computer system (STORET) for direct access.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Develop Computer Programs for Storage and Retrieval of Biological Data			05AEF 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. Meyerson General Electric Corporation Schenectady, New York		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$20,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is the development of field and laboratory data report forms, a hierarchical taxonomic coding system, and computer programs for storage and retrieval of biological data in STORET and correlation of computer-based biological, chemical and physical water quality data.

RESEARCH TASK / PROJECT TITLE Develop Biological Reference Samples for Interlaboratory Methods Studies		FY 1973 TASK NUMBER 05AEF 15	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Cornelius I. Weber Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/69	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$24,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to carry out interlaboratory evaluation and validation of biological methods considered potentially suitable for routine use by Agency field and laboratory personnel. The studies will be carried out jointly with personnel in the Methods & Performance Evaluation Activity, AQCL. Descriptions of the methods will be prepared and reference samples will be developed and distributed to participating laboratories. The results will be evaluated and reported jointly with the M&PE Lab. Methods which meet the established criteria will be included in the Biological Methods Manual. Reference samples currently under development include: Sedgwick-Rafter plankton counting, chlorophyll determination, diatom identification, and macroinvertebrate identification.

METHODOLOGY DEVELOPMENT FOR THE CONCENTRATION, RECOVERY
AND IDENTIFICATION OF VIRUSES FROM ANY WATER

RESEARCH TASK/PROJECT TITLE Quantitative Detection of Small Quantities of Viruses in Large Volumes of Water			FY 1973 TASK NUMBER 07AAP 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Gerald A. Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/76	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$100,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop methods that are relatively simple and inexpensive for detecting very small amounts of viruses in very large volumes of water. In an effort to develop such methods, a program has been undertaken to evaluate the effectiveness of different filter systems.

The membrane filter method for recovering small amounts of viruses from large volumes of water will be studied. The newly developed low pH approach (pH 3) will be tested and compared with pH for dis-tilled water, river water and effluents. Efficiency of recovery will be determined when salts are added and when they are absent. The newly developed virus recovery technique utilizing pH 11.5 elutant will be evaluated as will subsequent secondary concentration at pH 3. The Seitz filter and other filter pad systems will be evaluated as an alternate means of recovering enteric viruses from water.

RESEARCH TASK/PROJECT TITLE Viruses in Waters: Methods for Virus Detection and Removal			FY 1973 TASK NUMBER 07AAP 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Joseph L. Melnick, Baylor College of Medicine 1200 Moursand Avenue Houston, Texas 77025			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/15/70	EST. COMP. DATE 6/30/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$120,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Quantitative field studies will be conducted on the survival and distribution of enteric viruses in: (a) a minimally-polluted watershed system used as a source of municipal water supply for a major urban area; (b) "tertiary"-treated and reclaimed wastewaters; (c) polluted estuarine and marine waters; and (d) leachates from municipal solid waste landfills. A newly developed, portable virus concentra-tor which is capable of efficiently concentrating viruses from a variety of waters and wastewaters at a rate of up to several hundred gallons per hour, will be employed in this study. In this apparatus the water to be processed is first clarified by filtering through textile filters of graded porosity, and then the viruses present are concentrated by: (1) adsorption to textile virus adsorbers; (2) elution; and (3) subsequent reconcentration to a volume of several ml by adsorption to and elution from either membrane filters or aluminum hydroxide gels.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Quantitative Detection and Recovery of Viruses from Solids in Water			07AAP 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Gerald Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	12/30/77	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$50,000	
TASK / PROJECT DESCRIPTION AND REPORTS				

Methodology will be developed for recovering viruses from solids in water. The extent of adsorption of viruses to various solids in effluents and waste will be determined. The efficiency of virus recovery by direct titration of solids, will be evaluated. The study will describe the extent of virus adsorption to various solids in various effluents and waters and the efficiency of recovery by direct titration.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Preservation of Field-Concentrated Viruses During Transit			07AAP 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Gerald Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	12/30/77	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000	
TASK / PROJECT DESCRIPTION AND REPORTS				

Develop capacity for quantitatively preserving viruses, field-concentrated from large volumes of water, during transit for assay. Methods are to be developed for each concentration technique for which field utilization is anticipated. Present methods are being developed for preserving viruses from field-processed samples collected by the membrane filter technic.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Indicators of Enteric Viruses in Waste and Other Waters			07AAP 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Yehuda Kott, Associate Professor Technion, Israel Institute of Technology Haifa, Israel		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/1/73	6/5/75	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$28,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Correlations between enteroviruses and fecal bacteria in waters of various quality will be made using and comparing two methods for detection and isolation of enteric viruses as described below:

1. Enteroviruses will be recovered from raw wastewater and treated wastewater effluents by combinations of membrane filtration, and ultra-filtration (alginate filters).
2. Parallel samples will be treated with HCl to lower pH to 3.0, filtered on MF and eluted with 3% beef extract under sonication.
3. Samples containing not less than 1 PFU/ml will be counted directly (using high concentration of antibiotics).
4. Fecal coliform and fecal streptococcus counts will be taken in order to correlate both organisms with the viruses.
5. Water samples from water supply systems occasionally found to be polluted, will be checked for enteroviruses and *E. coli* B. bacteriophage, fecal coliforms, and fecal streptococci.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Removal of Viruses by Treatment Processes			07AAP 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER R. Safferman, Supv. Res. Microbiologist Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	12/30/77	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$25,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The degree of removal of viruses by waste treatment processes will be determined. Studies are to be conducted on a pilot plant scale examining various treatment trains for water renovation on a system-by-system basis. Data are to be used to ascertain the efficiency of present-day waste treatment practices for removing viruses and determining the additional treatment and innovations necessary to provide a virus-free effluent.

Studies are to be extended to evaluate removal potential of new treatment procedures as they are developed. Evaluations of viral removal efficacy are in progress on the three-stage activated sludge system at the EPA-Washington, D.C., Blue Plains pilot plant. Work is currently planned on the effectiveness of physical-chemical treatment methods with specific emphasis on the high lime system.

EVALUATION OF INDICATOR-ORGANISMS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Development of Improved Methods for Fecal Streptococci			07AAT 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
12/71	12/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$21,000

TASK / PROJECT DESCRIPTION AND REPORTS

Many procedures have been proposed for the isolation, identification and enumeration of fecal streptococci. Methods are available for their recovery and enumeration from water and wastewater. However, the methods for these slower-growing microorganisms require 48 hours and include some species which are ubiquitous and not of any recognized sanitary significance. The media do not measure the same groups of microorganisms. The objectives of this current research are to evaluate new and modified procedures and media for the fecal streptococci and develop a more rapid and specific method applied to water samples.

Two Standard Methods media and more recently developed Selective Enteric Medium have been evaluated with pure cultures and natural water samples from the local geographical area. A series of experiments have been carried out using elevated incubation temperatures, enrichment media, and modified media formulations with the MF technique using the KF test as the standard for recovery of fecal streptococci. The SEM medium is superior as a plating medium but has not yet been adapted to use with the MF.

Methods for individual species (e.g., *S. bevis*) and groups of species (*S. mitis-salivarias*) will be investigated. Efforts will continue to develop a 24 hour or less MF test. A research grant for the development of a fluorescent antibody technique may produce a rapid method for evaluation.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Investigation of the Use of the Membrane Filter for Chlorinated Effluents			07AAT 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
1/72	9/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

Microbiological examinations are performed on wastewaters to determine their sanitary quality and their effect upon receiving waters. The membrane filter technique would be advantageous for this purpose because it is more rapid, direct and accurate than the most probable number (MPN) procedure. However, Standard Methods, 13th Ed., points out that "experience indicates that the membrane filter technique is applicable to examination of saline water, but not chlorinated wastewaters." This statement is based upon previous reports of erratic results with these effluents. This research proposed to investigate the application of the membrane filter to chlorinated effluents in various types of treatment plants by comparing it to parallel MPN results for total and fecal coliforms. Various enrichment, resuscitation and sample mixing techniques will be investigated to achieve closer correlation of MF and MPN methods.

Approximately 100 effluent chlorinated and unchlorinated samples have been analyzed. MF results do not agree with the 95% confidence limits of the MPN except for secondary unchlorinated effluents analyzed for total coliforms. Various enrichment procedures have increased total and fecal coliform counts and brought them closer in line with MPN confidence limits. However, enrichment procedures have lengthened the time required for completion of the tests and attempts are being made to shorten the overall time requirements and maintain the validity of the results.

RESEARCH TASK/PROJECT TITLE Investigation of the Use of the Fecal Coliform Test for Industrial Effluents			FY 1973 TASK NUMBER 07AAT 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/73	EST. COMP. DATE 6/74	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The fecal coliform density has been proposed as the most appropriate parameter for the measurement of the public health hazard of certain industrial effluents such as those from food, meat, dairy, poultry, seafood, sugar, paper and pulp processing. The fecal coliform level is of concern whether domestic wastes enter the effluent system or are separated from it. The research objectives are to determine the applicability of the fecal coliform parameter to selected industrial effluents and identify problems with its use. Factors such as temperature, pH and turbidity may drastically affect the fecal coliform count. Other microorganisms present may suppress the growth and recovery of fecal coliforms. Other closely related groups such as Klebsiella may affect the count. The dominant species present and the source, if domestic wastes are separated, are of interest. In-plant studies may be helpful. Toxic and nutrient materials in the wastes will be measured. Appropriate fecal coliform standards will be determined.

The approach will study natural samples representative of various types of effluents to determine levels of fecal coliforms to be expected. Other characteristics of the effluents and environmental factors and their effects upon the fecal coliform population will be investigated. Modified or alternate methods will be investigated.

RESEARCH TASK/PROJECT TITLE Rapid Field Test for Salmonella and Other Pathogenic Bacteria in Streams			FY 1973 TASK NUMBER 07AAT 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard K. Miller Fairfax County Health Department Fairfax, Virginia			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert H. Bordner Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 2/73	EST. COMP. DATE 3/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$40,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The need for rapid methods for the identification of Salmonella and other pathogens is critical enough to warrant the pursuit of more than one promising approach. This research grant proposal is a feasibility study of a rapid and sensitive screening method developed by the Atlantic Research Corporation for the detection of enteric pathogens by testing for the presence of bacteriophages capable of lysing them. Plates seeded with a panel of representative pathogens are observed for plaque formation caused by homologous phages present in water. The study would be carried out on polluted streams receiving treated and untreated industrial and domestic wastes as well as relatively clean streams in Fairfax County. The technique may be adaptable to automatic monitoring.

The reversed phage titre procedure proposed offers a possible rapid screening test for pathogens in water after careful investigation of: (1) its limits of specificity and selectivity; (2) the effect of industrial waste, disinfection and other waste treatment procedures upon phage; and (3) technical difficulties such as false plaques or the obscuring of plaque formation by confluent bacterial growth. Problems in interpretation of results will include the viability of the bacteriophage in water, recency of the pollution, the baseline values for bacteriophage, and the possibility that enteric pathogens may be present without their homologous phage, or conversely, that the phage may occur naturally in the absence of the host bacteria.

QUANTIFICATION OF PHYSICAL AND CHEMICAL POLLUTANTS IN WATER

RESEARCH TASK / PROJECT TITLE Identification of Organic Pollutants by GC/MS-NMR			FY 1973 TASK NUMBER 09ABZ 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER William L. Budde, Organic Instrumentation Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 7/75	METHOD OF SUPPORT ☒ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$90,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to develop detailed and practical GC/MS and NMR techniques to identify organic pollutants found in complex environmental mixtures. This instrumentation provides the most reliable and sensitive means for confirming the identity of organic compounds, tentatively identified by other means. The approach is to identify a large number of specific organic pollutants; determine the optimum conditions for analysis, detection limits, capability of computer controlled GC/MS specific mass monitoring techniques for enhancing the sensitivity for specific compounds; develop standard procedures for tuning up the GC/MS system and develop quantitative GC/MS techniques; compare and evaluate existing computer mass spectral matching programs for identification of unknown organic compounds; and provide confirmatory identification of unknown organic compounds as required by surveillance, enforcement, and compliance with standards programs. A method for specific mass monitoring GC/MS of polychlorinated biphenyls is being prepared for publication. Work on selection of a standard reference compound and preparation of standard procedures for tuning the GC/MS system are in progress as is work on development of quantitative analysis techniques. Application of the GC/MS to determine specific organic compounds in domestic and industrial wastes is planned. To increase the capabilities and versatility of the PDP-8/E computer that accompanies the Finnigan 1015 Mass Spectrometer, a Tektronix computer input/output terminal has been interfaced via telephone line to remote time-sharing computers which provide spectral matching programs. Programs to utilize the graphic display capabilities of the terminal will be written. Application of the NMR to characterization of industrial wastes which are not amenable to GC/MS analyses is planned.

RESEARCH TASK / PROJECT TITLE Methods for the Identification of Pesticides and Other Organics in Water and Bottom Samples			FY 1973 TASK NUMBER 09ABZ 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James J. Lichtenberg, Pesticides Ident. Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 7/75	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$55,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to provide reliable and standardized methods for the isolation, identification, and quantitation of organic pesticides and other organic compounds in water and bottom samples, to insure the quality and validity of the analytical data obtained by a single laboratory and the comparability of data from one laboratory to another. The methods are intended for use in support of surveillance, enforcement, and compliance with standards programs. The approach is to conduct application and development research to provide the needed methods. Methods currently available from the literature or other sources are evaluated. They are modified or new methods are developed as required. Methods for sample collection, preservation, extraction, clean-up, separation, detection and quantitation are investigated. The most common method for detection and quantitation is gas chromatography. Other methods such as liquid chromatography, thin-layer chromatography and infrared spectroscopy are employed where appropriate. New and selective instrumental methods for qualitative and quantitative determination as well as for confirmatory analysis are investigated. Methods for organochlorine pesticides have been published and copies are available through this office. Drafts of methods for organophosphorus pesticides, phenoxy acid herbicides, and polychlorinated biphenyls in water and bottom samples are in preparation. Types of compounds under study are the organonitrogen pesticides, chlorinated hydrocarbon solvents, and chlorinated naphthalenes. Methods for other specific organic compounds will be developed as the need arises.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Continued Development and Improvement of Automated Procedures			09ABZ 15	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert L. Booth, General Analyses Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	7/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$40,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to evaluate, modify and develop automated analytical procedures that can be routinely used in the laboratory and that may be adaptable for continuous monitoring use in the field to detect sources of pollution, to determine trends, and to measure treatment efficiency.

The approach is to evaluate such systems in the laboratory on a wide variety of sample types, ranging from comparatively clean river waters to raw sewages and waste outfall samples. Determination of precision and accuracy, working ranges, and comparability to approved EPA methods are made to establish equivalency of evolved methods.

Automated methods for the completely automatic determination of total phosphorus and total Kjeldahl nitrogen, either separately or concurrently, have been developed. Current research is on an automated method for phenolics, including the distillation step.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Quality Control Techniques for Insuring Data Validity			09ABZ 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert L. Booth, General Analyses Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
3/71	6/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$20,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop quality control techniques at the laboratory analyses level that can be routinely used to insure documentation of methodology and validity of data. Initial approach was to develop a handbook covering all laboratory aspects of quality assurance under a single reference source. Result was a "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" that has been distributed to approximately 20,000 requestors. Currently, use of quality control chart techniques are being evaluated in various laboratories, precision-accuracy documentation techniques are being used in methodology research, and techniques to establish equivalency of test procedures are being evaluated.

RESEARCH TASK / PROJECT TITLE Evaluation of New Analytical Instruments for Water and Wastes Analysis			FY 1973 TASK NUMBER 09ABZ 17	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert L. Booth, General Analyses Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/72	EST. COMP. DATE 7/74	METHOD OF SUPPORT ☐ Contract ☒ Intramural ☐ Grant	FUNDING INFORMATION Federal Cost: \$20,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to evaluate new types of instruments and redesigned instruments before their general acceptance for routine use in analyzing water and waste samples.

The approach is to evaluate such instruments on a variety of waters and wastes, under potential interfering conditions, and, where applicable, compare to existing approved EPA methodology.

Evaluations have been completed on Ionic's TOD unit, Dohrmann's TOC unit, and Beckman's DO meter. Current studies are on the Technicon Monitor IV.

RESEARCH TASK / PROJECT TITLE Evaluation of Ion Selective Probes as Analytical Tools			FY 1973 TASK NUMBER 09ABZ 18	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert L. Booth, General Analyses Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/72	EST. COMP. DATE 7/74	METHOD OF SUPPORT ☐ Contract ☒ Intramural ☐ Grant	FUNDING INFORMATION Federal Cost: \$20,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to evaluate existing and newly-developed ion selective probes on a variety of water and waste sample types to determine their potential use in the measurement and/or continuous monitoring of ambient and point sources of pollution.

The approach is to evaluate probes on actual sample types to determine potential background interferences and the reliability of probe measurements compared to wet chemical techniques that are time consuming and require special glassware. Determinations of precision, accuracy, and working ranges are also made to ascertain equivalency of probe techniques with existing EPA methodology.

Evaluations have been completed on the ammonia probe (similar to those done on the previously-tested fluoride probe). Current studies are on evaluations of the nitrate and cyanide probes.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Development of Instrumental Methods for Trace Metals			09ABZ 19
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John F. Kopp, Trace Metals Analysis Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	7/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$5,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to investigate and develop promising instrumental methods for trace metals. Fluorescence spectrophotometry is a sensitive and promising technique for a variety of trace metals. A fluorometric method for selenium has been proposed but must be investigated to determine its applicability and reliability. In addition, microwave plasma excitation has been proposed as a new excitation source. This technique also holds promise but must be investigated in greater detail.

The microwave plasma excitation source has been investigated for metals such as antimony, zinc, cadmium, arsenic, and mercury. Results have been encouraging but considerable developmental work is necessary before the technique can be recommended for general use.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Improvement and Evaluation of AA Methods for Trace Metals			09ABZ 21
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John F. Kopp, Trace Metals Analyses Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	7/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to improve and evaluate existing atomic absorption methods for trace metals. Improved methodology capable of extending trace metal detection limits is continually being sought. As new techniques and instrumentation are found to be workable, recommendations will be made as to their applicability.

An ultrasonic nebulizer has been investigated as a means of providing increased sample to the burner of the atomic absorption spectrophotometer. Interfacing the nebulizer to the burner assembly presented some difficulties. Of those metals examined, little improvement was noted and the investigation has been delayed by higher priority tasks.

QUANTIFICATION OF PHYSICAL AND CHEMICAL POLLUTANTS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Analyses of Asphalts by Electron Capture Detector Gas Chromatography			16AJA 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Fred K. Kawahara, Oil Identification Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
12/72	6/30/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to develop gas chromatographic method that will identify spilled oil products (asphalts). The approach is to fingerprint minor components in asphalts by use of fluorinated derivatives and analyze by use of gas chromatography with electron capture detector.

From the evaluation of gas chromatograms obtained with flame ionization detector, it became obvious that the application of conventional method of fingerprinting asphalts via FIDGC is unsuitable as one or two GC peaks would not provide diagnostic information. We are applying with success the gas chromatographic method (with electron capture detector) of analyzing minor components, e.g., phenols and mercaptans as pentafluorobenzyl ethers and thioethers, to provide fingerprints from asphalts after silica gel percolation. Currently, we are examining asphalts of all types produced by leading petroleum companies.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Characterization of Infrared Spectra of Heavy Petroleum Products Via Statistical Analysis			16AJA 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Fred K. Kawahara, Oil Identification Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
11/72	6/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to develop discriminant function analysis that would classify mathematically petroleum products. From a large population of each product, the approach is to determine linear discriminant functions that would provide mathematical descriptions for characterization and/or identification of each product.

An unusual combination of infrared absorbance measurements, data treatment and transformation, discriminant function analysis through computer assistance, has resulted in a more precise and accurate method of distinguishing asphalts and No. 6 fuel oils. Results show that asphalts and No. 6 fuel oils not taken from the original 147 replicates used for the development of the procedure, but representative of the two groups, can be classified with a high degree of accuracy. Moreover, the spill sample may be coupled to a source. The potential for detailed identification of environmental samples is recognized.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Analysis of Lube Oils by Electron Capture Detector Gas Chromatography			16AJA 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Fred K. Kawahara, Oil Identification Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	6/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to develop a gas chromatographic method that will identify spilled lubricating oils. The approach is to fingerprint minor components in lubricating oils by use of fluorinated derivatives and analyze by means of gas chromatography with electron capture detector.

Heavy lubricating oils may now be identified by means of gas chromatography, minor components of oils may be chemically reacted to effect pentafluorinated fingerprints. Fractionation via silica gel percolation provides eluates which show defined and numerous gas chromatographic peaks in contrast to a gross, singular, non-entity profile commonly characteristic of previously attempted gas chromatographic technique with flame ionization detector. We are examining lubricating oils of various types produced by leading petroleum companies.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Examination of Chemical and Physical Properties of All Types and Sources of Oils and Products by Various Types of Instrumentation			16AJA 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Fred K. Kawahara, Oil Identification Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
8/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$20,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to examine by various instrumental methods, the chemical and physical properties of all types of oils and products. The approach is to use various instrumental techniques and methods that may be useful for the identification of all types of oils and products.

VIRUS INACTIVATION STUDIES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Inactivation of Viruses and Viral Nucleic Acid by Halogens			21ARN 02-05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Gerald Berg, Chief of Virology Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/1/72	3/31/76	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$27,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Studies are to be conducted on the effectiveness, stability and reliability of halogens on viral inactivation. Special attention will be given to free infectious viral RNA. Prior to disinfection studies, evaluations will be made of the assay sensitivity of infectious viral RNA in a continuous cell line using preinoculation treatments. RNA extraction and concentration procedures will be optimized for several enteroviruses. The degree of inactivation of intact virus and infectious RNA will be determined by plaque and animal assays.

MUNICIPAL SEWERED DISCHARGES 1B2033

OUTPUT: New or improved technology for the effective and economical control of pollution from municipal sewer discharges. Program efforts will be directed to demonstrate technologies for nutrient removal, removal of organic materials and other pollutants so that municipal sectors will be able to achieve compliance with present and future water quality standards. Improved methods of operating both new and existing treatment plants will be developed and demonstrated. This effort will include major pilot plant work devoted to developing advanced treatment systems as well as full-scale demonstration projects.

DEMONSTRATION OF ADVANCED TECHNOLOGY TO ACHIEVE NON-POLLUTING MUNICIPAL DISCHARGES

RESEARCH TASK / PROJECT TITLE An Advanced Physical-Chemical Wastewater Treatment Process for the Housing and Community Development Industries			FY 1973 TASK NUMBER 21AAA 01
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Russel S. Bodwell, Vice President Levitt & Sons, Inc., A Subsidiary of IT&T Lake Success, New York 11040		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/15/71	EST. COMP. DATE 12/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$250,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the performance, economics, and applicability of a physical-chemical domestic wastewater treatment system designed to provide high quality discharges for isolated or developing communities having an average wastewater flow in the 25,000 to 500,000 gpd range. The plant provides chemical clarification, magnetic filtration, activated carbon adsorption, and chlorination for the liquid stream. Sludges generated will be incinerated in a fluidized bed incinerator. This device will also be utilized for regenerating the activated carbon. All of the treatment equipment is housed in a structure similar to the frames of the houses in the subdivision. The treatment plant is on a standard subdivision lot, and has essentially no buffer zone. The plant was dedicated in November 1972, and is now in its evaluation phase.

RESEARCH TASK / PROJECT TITLE Piscataway Model Advanced Waste Treatment Plant			FY 1973 TASK NUMBER 21AAA 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alfred Machis Washington Suburban Sanitary Comm., 4017 Hamilton Street Hyattsville, Maryland		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Thomas P. O'Farrell, EPA-DC Pilot Plant NERC, Cincinnati, EPA, 5000 Overlook Ave. Washington, D.C. 20032	
BEGINNING DATE 5/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$488,171 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives are to develop or confirm full scale design data for the various processes within the plant, to determine seasonal effects on the operation of the processes at full plant scale, and to provide operating cost information. The SMGD Model Advance Waste Treatment Plant consists of two stage lime treatment, dual media filtration, water stabilization, carbon adsorption, sludge thickening, lime sludge dewatering or classification (centrifuge), lime sludge recalcination, and carbon regeneration. The plant is fed effluent from a conventional step aeration activated sludge plant and removes carbon, phosphorus and solids from the water. For phosphorus and solids removal, the two stage lime system may be operated as high pH lime treatment (pH ~ 11.5) followed by recarbonation to pH 9.5 and second stage sedimentation of the CaCO₃ precipitated by recarbonation, or as two parallel single stage lime - FeCl₃ chemical clarifiers. The lime recovery system permits lime recovery and recycle with and without the recycle of non-carbonate solids. The plant centrifuges may be operated either for total capture of the thickened solids or for classification (separation) of CaCO₃ from the non-carbonate solids. The operation is a cooperative effort of EPA and WSSC personnel.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Lake Restoration by Phosphorus Control			21AAA 15 & 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ernest J. Petermel, City Clerk-Treasurer Utilities Dept., City Hall, City of Ely Ely, Minnesota 55731			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert M. Brice Shagawa Lake Restoration Project 222 W. Conan Street, Ely, Minn. 55731	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/9/71	6/30/76	☐ Contract ☒ Grant ☒ Intramural	Federal Cost: \$270,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The primary objective of this project is to restore Shagawa Lake bordering the City of Ely, Minnesota from a highly eutrophic condition to a healthy state.

To accomplish the above objective, it was determined to be necessary to substantially upgrade the quality of and to remove essentially all phosphorus from the City of Ely's high-rate trickling filter plant effluent. This effluent constitutes virtually a point source of phosphorus discharge into the lake. A 1.5 mgd tertiary treatment plant has been constructed to further treat the trickling filter effluent. Tertiary facilities consist of flow equalization, two-stage lime clarification, dual-media filtration, and chlorination. Lime sludge will be disposed of via gravity thickening, vacuum filtration, and trucking to sanitary landfill. The concentration of phosphorus being sought in the tertiary effluent is 0.05 mg/l as P, or less.

In April 1973, three years of carefully-controlled operation (using EPA and City personnel) was started, during which time it is hoped the restoration of Shagawa Lake can be demonstrated.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Transportable Advanced Wastewater Treatment Plant for Interim Use			21AAA 37	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Joseph E. Sunday, Director, Dept. of Public Works County of Fairfax, 4100 Chainbridge Road Fairfax, Virginia 22030			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Walter A. Feige Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/6/70	*Unknown	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$97,820 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project was to operate a transportable advanced waste treatment plant of approximately 75,000 gpd capacity that would satisfy the treatment efficiency recommended by the Potomac River Enforcement Conference for 1980 in Zone 1 of the River. However, there was extensive damage by Hurricane Agnes on June 22, 1972, and termination of the project is now under consideration.*

The facility was to be operated for a 12-month period to evaluate its dependability, efficiency, operational characteristics, and its economics. The approach to meet strict effluent standards (5 mg/l BOD, 2.5 mg/l nitrogen, 0.2 mg/l phosphorus, and trace amounts of suspended solids) was to be through a combination of physical, chemical, and biological treatment. The planned treatment scheme was flow equalization, chemical clarification, biological nitrification (activated sludge), upflow columnar denitrification (with methanol), pressure filtration, and chlorination.

RESEARCH TASK / PROJECT TITLE Tertiary Treatment of Combined Storm Water, Sanitary Relief Discharge and Sewage Treatment Plant Effluent			FY 1973 TASK NUMBER 21AAA 50
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Joseph Rakowski, Supt., The Sanitary District of Chicago 5200 Indianapolis Boulevard East Chicago, Indiana 46312		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Carl A. Brunner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/1/66	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$450,000 (67)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop and verify, on a small pilot scale, the preliminary design and operating conditions for chemical coagulation, sedimentation, dual media filtration, and granular activated carbon adsorption for treatment of combined municipal-industrial wastes mixed with storm run-off. This pilot-plant unit will be operated for approximately four months. In addition, the aim is to design and construct a minimum 1-MGD pilot plant to include the operation of the above process steps.

RESEARCH TASK / PROJECT TITLE A Study of the Feasibility of Flow Smoothing Stations in Municipal Sewage Systems			FY 1973 TASK NUMBER 21AAA 51
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR C. N. Click, Env. Engr. (Presently with Illinois EPA) Research Triangle Institute Research Triangle Park, North Carolina 27709		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER H. E. Bostian Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/1/70	EST. COMP. DATE 1/31/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$23,137 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

Flow Smoothing in sanitary sewers was studied to determine under what conditions the resulting higher flow capacities can be economically obtained. Conservative assumptions were made in this preliminary design and economics study to provide a severe test for the cost effectiveness of the concept. In many situations, flow smoothing is an attractive alternative when compared to relief pipe installation. Circumstances which favor flow smoothing are high interest rates, high peak-to-average flow ratios, low pipe slopes, small diameters, and low design depths of flow. Flow smoothing is strongly favored where earthen construction can be utilized. The project is being closed and the following publications have been prepared:

Click, C.N., "The Feasibility of Flow Smoothing Stations in Municipal Sewage Systems."
Environmental Technology Series Report EPA-R2-73-138, January 1973. To be published.

Click, C.N., and Mixon, F.O., "The Feasibility of Flow Smoothing in Sanitary Sewers."
Being submitted to J.WPCF.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Demonstration of Waste Flow Reduction from Households		21AAA 52	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Sheldon Cohen, Sr. Chem. Engr., Electric Boat Division General Dynamics, Eastern Point Road Groton, Connecticut 06340		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER H. E. Bostian Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
2/24/71	7/24/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$50,642 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

Water savings will be evaluated for using reduced flow toilets and shower heads and for reusing laundry and bath water for toilet flushing and lawn watering. Eight test homes are being used for the study. The program calls for 6 months of normal usage, followed by 12 months with water-saving devices, and then 6 more months of normal usage after the devices are removed.

The period with water savings devices has been completed. Data analyzed to-date provide the following results. Shallow-trap and dual-flush toilets have resulted in average decreases in toilet water usage of 24 and 4%, respectively. Flow restricting shower heads have decreased bath water usage by an average of 2%. Where wash water recycle systems for toilet flushing have been installed, reduction of total water usage ranged between 23 and 33%. When the recycle systems in two homes were also used to provide water for lawn sprinkling, net flow to the septic tanks decreased by an average of 16 gpd.

Preliminary economic estimates based on cost of water saved indicate that flow reduction devices are attractive for individual homes. On the other hand, wash water recycle systems may not be justified by water savings alone, unless one unit is used for multiple dwellings.

WASTE PRETREATMENT "IN-SYSTEM" TREATMENT AND MANAGEMENT OF SEWER SYSTEMS

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Feasibility Study on In-Sewer Treatment Methods		21AAC 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard Pomeroy, Pomeroy, Johnston and Bailey 660 South Fair Oaks Avenue Pasadena, California 91106		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
9/70	5/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$69,525 (71)

TASK/PROJECT DESCRIPTION AND REPORT

The objectives are to determine technical and economic feasibility of in-sewer treatment, and recommend future work. The approach basically, is to conduct a desk top study with limited experimentation on oxygen transfer.

The final report is being prepared. The most promising approach is biological treatment for BOD removal. Appreciable BOD reduction occurs normally in sewers. Requirements are adequate oxygen supply, oxidizing culture and time. Cultures can be suspended or attached to solid surfaces. Various methods were explored for oxygen addition. Prospects for in line sewer treatment are good, especially in force mains.

COMBINED SEWER OVERFLOWS AND STORM WATER DISCHARGES 1B2034

OUTPUT: New or improved methods of abating pollution caused by (1) discharge of untreated or inadequately treated waters from sewers which carry either storm water or both storm water and sewage; and (2) urban runoff not collected and carried in sewers to a point discharge. Program efforts will be to characterize the quality and pollution impact of these wastewaters and to develop methods (processes, hardware, and techniques) for their control and treatment. Emphasis will be placed on advanced technology for full-scale plant systems.

STORM AND COMBINED SEWER FLOW CONTROL

RESEARCH TASK/PROJECT TITLE Wastewater Flow Measurement in Sewers Using Ultrasound			FY 1973 TASK NUMBER 21AAF A1
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ronald J. Anderson, Sewerage Commission of the City of Milwaukee, P. O. Box 2079 Milwaukee, Wisconsin 53201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 3/26/71	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$146,250 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to improve sanitary, storm and combined sewer regulation by application and demonstration of new technology for measurement of sewage volume flow. To implement this objective, two sewers in the Milwaukee Metropolitan Sewerage System will be instrumented with newly developed ultrasonic velocity and level measurement equipment. The purpose of the equipment is to provide a measurement of sewage volume flow suitable for regulation systems which, in addition to conventional gravity flow, involve sewage, gating, pumping and short-term retention of storage. The sewage metering equipment to be demonstrated is of sufficiently low cost to achieve general use, can be conveniently installed in existing sewers, is non-fouling and is suited by design to long-term operation in the sewer environment.

RESEARCH TASK/PROJECT TITLE Development of New and Improved Devices for Automatic Sampling of Sewer and Combined Sewer Flows			FY 1973 TASK NUMBER 21AAF A2
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Phil Shelly, Hydrospace-Challenger, Inc. 2150 Fields Road Rockville, Maryland 20850		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/72	EST. COMP. DATE 8/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$115,946 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The project is a seventeen-month development and demonstration of devices capable of collecting and preserving representative samples of sewage from storm and combined sewers under all expected flow conditions. Work planned includes development of a complete state-of-the-art and assessment of sampling equipment and techniques, including types of samplers and advantages and limitations of each with respect to S & CS conditions, engineering to adapt and/or modify existing sampling equipment to effective operation under S & CS conditions.

New concepts will be considered if the preliminary data submitted indicates feasibility; assemble and laboratory test each sampling device, report demonstrating the device capable of meeting usage requirements, installation of device at suitable field test site and on-site evaluation of the device under actual operating conditions.

RESEARCH TASK/PROJECT TITLE Use of Polymers to Reduce or Eliminate Sewer Overflow in the Bachman Creek Sewer			FY 1973 TASK NUMBER 21AAF 0311
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR A. E. Holcomb, City of Dallas 500 South Ervay Street Dallas, Texas 75201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert Hiller Region VII, EPA, 1735 Baltimore Avenue Kansas City, Missouri 64108	
BEGINNING DATE 5/23/69	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$331,233 (69)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to design, construct, and evaluate a permanent polymer injection station on the Bachman Creek Sewer in Dallas, Texas. This project will further demonstrate and evaluate a technique developed earlier for FWPCA by contract which utilizes injection of polymers into a sewer for the purpose of increasing the carrying capacity of the pipe. During periods of wet weather, the Bachman Creek sewer receives excess quantities of ground or storm water due to infiltration. The flow then exceeds its carrying capacity and untreated wastes overflow in at least ten locations, causing pollution of Bachman Creek. This project will seek to eliminate or greatly reduce the number of volume of untreated overflows by increasing the flow capacity of the Bachman Creek Sewer through the addition of polymers. Design criteria, operating techniques, optimum polymer concentration and other pertinent data critical to the intended use will be evaluated.

RESEARCH TASK/PROJECT TITLE The Construction and Technical Evaluation of the Various Aspects of An Aluminum Storm Sewer System			FY 1973 TASK NUMBER 21AAF 0312
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR James J. Giordano, Chamlin & Associates 3017 Fifth Street, Peru, Illinois 61354 For Grantee: City of LaSalle LaSalle, Illinois		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risely, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 6/23/69	EST. COMP. DATE 4/23/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$432,276 (69)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the correction of combined sewer overflow problems by constructing a separate storm drainage system for a portion of the city. Engineering study indicates that this is the most economical solution for the city. The development and demonstration aspects will be:

1. installation and evaluation of performance, durability, and dependability of various size corrugated aluminum pipe;
2. prototype development and evaluation of improved joint couplers, tapping saddles, catch basins and manholes;
3. a detailed cost analysis to allow comparison of aluminum pipe with a commonly used sewer material; and
4. a construction practice evaluation for future installation guidance.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Trenchless Sewer Construction and Sewer Design Innovations		21AAF 0313	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR D. Russell Tatman, Edward H. Richardson, Assoc., Inc. 153 Chestnut Hill Road, Newark, Delaware For Grantee: Sussex County Council Georgetown, Delaware		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER H. E. Masters Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/18/72	6/30/75	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$796,238 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The project is to demonstrate a new sewer construction method which will be less costly and more rapid than conventional construction, and overcome the problems of high water table, unstable soil, associated infiltration and expensive manhole installation. The technique is to utilize the "trenchless" pipe laying system developed in England. The process uses an electro-optically-controlled blade which "plows in" the pipe as it moves along. Other important sewer design innovations will be demonstrated: new manhole construction and substitute cleanouts, improved sewer piping (PVC), jointing, and coating materials and a new screw type sewage pump which requires no wet well. A thorough two year post-construction evaluation is to be included.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Rainfall-Runoff Relations on Urban (and Rural) Areas		21AAF 0415	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR E. F. Brater, Department of Civil Engineering University of Michigan Ann Arbor, Michigan 48104		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert Buckley Region V, EPA (Lake Huron Basin), Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
12/1/68	5/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$60,031 (69)

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to gain a better understanding of the factors which control the relationship between storm rainfall, or snow melt, and the resulting storm runoff, and to determine the effect of urbanization on this runoff process. The benefits would include prevention of flood damage by means of improved design of storm sewers and waterways, and would provide data needed for the improved design and operation of facilities for control of pollution due to storm water and/or combined sewage.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Portable Device for Measuring Wastewater Flow In Sewers			21AAF 0506	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR H. R. Thacker Hittman Associates, Inc. Columbia, Maryland		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Harry Torno Office of Research & Development, EPA Waterside Mall, Washington, D.C. 20460		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
10/1/70	5/31/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$137,200 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop a portable flow measuring device to overcome the adversities imposed by storm water discharges on conventional instrumentation. The instrument is based on the properties of electrical capacitance of a sewer cross-section with wastewater forming part of the dielectric and the volumetric flow rate measured directly by introducing a tracer (small air bubbles) immediately upstream from the measurement electrodes.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Combined Sewer Fluidic Regulator Demonstration			21AAF 0528	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Carmen F. Guarino, Philadelphia Water Department City of Philadelphia, 1160 Municipal Services Building Philadelphia, Pennsylvania 19107		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/18/70	5/18/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$77,410 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

This project would utilize the design rationale developed under FWQA Program No. 11024 DGZ, (Contract 14-12-486) in the design, construction and operation of a full-size combined sewer fluidic regulator installed in two typical locations in the Philadelphia sewer system.

The specific objectives of the project are the following:

1. Design, construction and operation of a fluidic regulator for a flow range below 2 CFS with a minimum of reconstruction. The unit will be capable of demonstrating fluidic action on demand by use of city water to simulate storm flow and a transparent top for observation.
2. Design, construction, and operation of a fluidic regulator for a 4 CFS peak dry weather flow. This will demonstrate the use of a fluidic device at higher flows on combined sewerage. The automatic control of the overflow will be done by sensing the interceptor level. No overflow will occur until the interceptor reaches a pre-determined limit.
3. Evaluate the operation of above fluidic devices over a years' period, and relate their performance, both advantages and disadvantages to conventional regulator throughout the Philadelphia sewer system.
4. Assembly of all data from the evaluation and testing program including rainfall data, overflow vs. sensor height, so that the application of fluidics to sewer design can be demonstrated on a full-scale basis.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
The Lawrence Avenue Underflow Sewer System			21AAF 0609
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR City of Chicago, Department of Public Works Chicago, Illinois (For information, contact Project Officer)		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
3/30/67	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$1,500,000 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to evaluate the effectiveness of employing a deep tunnel system within a highly developed urban area to temporarily store excess combined sewer flows for return to the sewage treatment plant during off-peak hours. This project will reduce the discharge of untreated combined sewage to the receiving stream and minimize overloading the waste treatment plant. Should this method of control prove to be economically feasible, the use of advanced tunneling equipment, present plans in the Chicago metropolitan area envisions a vast network of deep tunnels for ultimate control of all waters in excess of that which can be conducted by the existing drainage systems.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Demonstration of an Underground Storage Silo-Vortex Regulator/Solids Separator System for Control of Combined Sewer Overflows			21AAF 0615
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Thomas Darmody, Meridian Engineering, 1776 Benjamin Franklin Pkwy., Philadelphia, Pennsylvania 19103 For Grantee: City of Lancaster, 120 North Duke Street Lancaster, Pennsylvania 17604		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NFA/C-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/1/71	3/31/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$1,289,250 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is the demonstration of the feasibility of controlling combined sewer overflows by storage in an underground 1.175 MGD "silo" which can offer benefits in minimizing use of valued surface land. Stored flow will be discharged to the existing municipal sewerage system for subsequent treatment during the non-peak flow periods. Excessive overflows caused by intense rain-falls which cannot be contained in the "silo," will be treated by fine mesh screens and disinfected prior to discharge. A submerged turbine-draft tube device will be installed in the 95' deep "silo" to demonstrate a method of deep tank mixing and aeration with relatively low power and maintenance requirements. A vortex device will be developed and demonstrated, which will have the dual capabilities of overflow regulation (controlled diversion) and treatment by liquid-solids separation. During overflows, the concentrate will be directed to the existing sewerage system, whereas the relatively clear liquid will be directed to the "silo" for storage. The grantee will employ the Storm Water Management Model as a design and evaluation tool. The model will also be further developed to include a decision-making capability to identify effective least-cost alternatives as part of the development and implementation of a plan for control of combined sewer overflows for an entire urban area, using the City of Lancaster as an example.

RESEARCH TASK/PROJECT TITLE Demonstration of Void Space Storage with Treatment and Flow Regulation			FY 1973 TASK NUMBER 21AAF 0638
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR C. E. Susong, City of Akron 166 South High Street Akron, Ohio 44308		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER George Harlow Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 5/23/69	EST. COMP. DATE 5/23/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$562,500 (69)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to construct, operate, and evaluate an underground storage/treatment facility for excess combined sewage. The facility will include novel concepts in construction and operation. It will be an excavated hopper-shaped cavity, lined with an impermeable membrane, filled with an inert material, covered with soil and the surface made usable. Storage will be in the void space of the fill. The flow regulation of influent will be a new and improved device, probably a fluidic regulator. The sewage will be pretreated prior to entry to the storage facility. Tube clarifiers will be utilized to compare results with an on-going project where these units are being used for the first time at an operational level on combined sewage.

RESEARCH TASK/PROJECT TITLE Program for Demonstrating Combined Sewer Overflow Control Techniques for Water Quality Improvement and Beach Protection			FY 1973 TASK NUMBER 21AAF 0718
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR City of Cleveland, City Hall 601 Lakeside Avenue Cleveland, Ohio 44114 For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Sid Beeman Municipal Pollution Control Section, EPA Arlington, Virginia	
BEGINNING DATE 6/3/68	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$325,162 (68)

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to apply several control and treatment methods designed to abate pollution from combined sewer overflows and control of water quality at the Edgewater and White City bathing beaches on Lake Erie in the City of Cleveland. Control and treatment measures to be applied include:

1. hypochlorination of combined sewer overflows and local streams contributing to pollution of beach areas;
2. use of polymers to reduce overflows by increasing interceptor flow capacity;
3. initiation of a sewer flushing program to reduce solids discharged from the drainage area tributary to the Edgewater overflow;
4. screening of overflows and streams;
5. construction of sheet piling and flexible barriers to enclose beach areas;
6. control of water quality within enclosed beach areas;
7. collection of debris and coarse solids; and
8. miscellaneous sewerage system improvements.

RESEARCH TASK / PROJECT TITLE Boston University Bridge Storm Water Detention and Chlorination Station			FY 1973 TASK NUMBER 21AAF 0722
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Metropolitan District Commission, 20 Somerset Street Boston, Massachusetts For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Allyn Richardson Region I, EPA, John F. Kennedy Building Boston, Massachusetts 02203	
BEGINNING DATE 9/2/66	EST. COMP. DATE 5/2/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,000,000 (67)

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to construct a detention basin to intercept peak flows and to chlorinate wastewater, as a means of reducing combined sewage overflows into the Charles River. This project includes the construction and evaluation of a combined sewer overflow facility, designed to provide a ten-minute minimum sedimentation-detention time with an influent of 233 MGD. The chlorinated effluent will flow by gravity from the detention tanks through a 96-inch outfall pipe into the Charles River. Sludge deposits in the detention tanks will be returned to the sewer system to be treated at the sewage treatment plant. All settled materials will be flushed out of the tanks and into the sewer system after the storm subsides.

RESEARCH TASK / PROJECT TITLE Systems Monitoring and Remote Control			FY 1973 TASK NUMBER 21AAF 0803
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John W. Brown City of Detroit, Board of Water Commissioners 735 Randolph Street, Detroit, Michigan		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Lawrence O'Leary Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 2/14/66	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,000,000 (66)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is the reduction in stream pollution caused by combined sewer overflows by installation of modern control equipment for sewage flows thereby maximizing the use of storage within the existing sewer system. The project consists of installation of new power operated diversionary overflow structures and automatic control instrumentation. The instrumentation includes devices for determination of wastewater quality, flow measurement, rainfall data, conduit liquid level sensing, and remote operation of diversion gates. Telemetering will be provided to transmit and record data collected by the instruments and to provide feedback data relative to status of the remote controlled units. Investigations will be made to observe the modifications and additions to the system, to analyze and evaluate the data collected, and to determine the overall effectiveness of the demonstration.

RESEARCH TASK / PROJECT TITLE State-of-the-Art and Assessment of Storm and Combined Sewer Management and Treatment		FY 1973 TASK NUMBER 21AAF 1104	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John A. Iger Metcalf & Eddy, Inc., 1029 Corporation Way Palo Alto, California 94303		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 06/72	EST. COMP. DATE 8/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Project Cost: Federal Cost: \$199,209 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The project is a fourteen-month compilation, description, and assessment of promising S & CS pollution control processes useful for establishing a rational basis for planning and evaluating new projects and for assisting in future municipal planning and design efforts. Work planned includes sewer separation, its functions, purposes, limitations, true perspective based on modern technology, vacuum, and pressure alternatives, etc.; evaluation of control and/or treatment capabilities of facilities intended to function as alternatives to sewer separation as a means of abating pollution from sewer overflows; new developments in sewer line installation, materials, jointing, coatings, sealants, impregnation, etc., to reduce costs, alleviate infiltration and extend useful life by limiting corrosion and erosion; establishment of basis for design; levels of treatment efficiency expected from various treatment and/or control processes or combinations thereof; delineation and description of types and ranges of pollutants most amenable to removal, conversion, and appropriate handling within the specified system(s); description and evaluation of various math modeling techniques developed for "predictive" and "decision-making" purposes to augment stormwater pollution abatement systems; assessment of existing and new flow meters and sampling devices specifically for adaptability to measure wet-weather flow in sewers; complete economic evaluation of the above; assessment of applicability of all methods, facilities and systems employed for CS overflow to urban stormwater pollution control and unify terms, terminology, nomenclature, units, parameters related to S and CS overflow characterization, abatement facilities, treatment/control operation and practice.

TREATMENT OF COMBINED SEWER OVERFLOWS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Combined Sewers - Microstraining Pilot Tests			21AAH A1	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR C. F. Guarino, Water Commissioner Philadelphia Water Dept., 1140 Municipal Serv. Bldg. 15th & JFK Blvd., Philadelphia, Pennsylvania 19107			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/18/70	4/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$82,000 (70)	

TASK/PROJECT DESCRIPTION AND REPORTS

The proposal will essentially be an extension to the project evaluating microstraining and ozonation or chlorination as applied to the treatment of combined sewer overflow. Additionally, the application of polyelectrolytes will be investigated to determine their effect upon the removal of residual suspended solids. It is believed that the use of these polymeric materials will permit higher micro-strainer throughout rates because of agglomeration and strengthening of influent particulates combined with the intent to study polyelectrolyte usage. It is also proposed to use coagulant-precipitant such as alum, to research the possibility of removing total phosphates from the combined sewer overflow. To-date, under the present grant to the City of Philadelphia (11C23-FWT), it has been shown that suspended solids removal by high rate Microstraining varies between 40% and 95%, with average removals of about 75%.

The objectives of the proposed study are: (1) to investigate the application of polyelectrolytes to the Microstraining of combined sewer overflow to improve effluent quality and attempt to further increase throughout rates; (2) to investigate the use of suitable coagulant-precipitant in the process to remove total phosphates from combined sewer overflows; and (3) to extend the present program to acquire more complete data for evaluation of the process.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development of a Swirl Concentrator for Grit Removal			21AAH BJ	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Kenneth W. Cestari, Chief Engineer, Merridian Engrng., Inc. 1776 Benjamin Franklin Parkway Philadelphia, Pennsylvania 19103			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Supply Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
5/73	3/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$56,863	

TASK/PROJECT DESCRIPTION AND REPORTS

The City of Lancaster, Pennsylvania has proposed a supplement to their current demonstration project for which they have successfully developed the swirl device for dual use as a combined sewage treatment concentrator and an overflow regulator. The ongoing parent project is entitled "Demonstration of an Underground Silo-Vortex (Swirl) Regulator/Solids-Liquid Separator System for the Control of Combined Sewer Overflows," 11023 GSC. This supplemental grant will develop and evaluate the swirl concentrator as a grit removal device. The same facilities and expertise utilized for the fruitful past development of the swirl concentrator as an overflow regulator will be used for the proposed work which offers direct economic benefits and a high probability for success. Both the previously developed swirl flow regulator/solids-liquid separator and the newly proposed swirl degritter, will be installed as full-scale prototype series operations at the Lancaster, Pennsylvania demonstration site under facility construction monies already set aside by the original project grant (11023 GSC). The device is of simple annular-shaped construction and requires no moving parts. It provides treatment by swirl action which imparts liquid-solids separation. The grit remains at the bottom of the chamber, whereas the relatively clean liquid overflows into a central downshaft. Treatment can be effectively accomplished at a small fraction of the detention time required for conventional processes. A design manual-type final report will result.

*For Grantee: City of Lancaster, Municipal Building
 120 North Duke Street, Lancaster, Pennsylvania 17604

RESEARCH TASK/PROJECT TITLE Nutrient Removal Using Existing Combined Sewer Overflow Treatment Facilities			FY 1973 TASK NUMBER 21AAH 56
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Frank Drehwing, O'Brien & Gere Engineers, Inc. 1304 Buckley Road Syracuse, New York 13201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 5/73	EST. COMP. DATE 10/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$121,570

TASK/PROJECT DESCRIPTION AND REPORTS

This work will be a supplement to the ongoing Onondaga County, New York grant 11020 HFR. It will test/evaluate the feasibility of nutrient removal with additional process units at a full-scale combined sewer overflow treatment demonstration site in Syracuse, New York.

Alum will be fed at the proposed filter inlet and the alum flox will be allowed to penetrate into the anthracite media which will affect phosphate removal. Furthermore, the ammonia nitrogen will be reduced by the zeolite media at the bottom layer of the filter bed. The system is expected to have 80% of nutrient removal efficiencies.

Regeneration of alum sludge and exhausted zeolite as well as Badger solids monitor will also be evaluated.

*For Grantee: Onondaga County Department of Public Works
650 W. Hiawatha Blvd., Syracuse, New York 13202

RESEARCH TASK/PROJECT TITLE Development and Demonstration of Combined Sewage Treatment Utilizing Screening and Split-Flow Air Flotation			FY 1973 TASK NUMBER 21AAH 0411
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William Katz, Re-Chainbelt, Inc. Technical Center Milwaukee, Wisconsin		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risely, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 10/6/67	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$378,322 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to study, design, fabricate, and demonstrate a system for the treatment of combined sewer overflows using new techniques of screening chemical oxidation and/or air flotation. The system to be studied will evaluate fine screening techniques for solids removal followed by chemical oxidation and disinfection or air flotation and disinfection prior to discharge of the effluent. The fine screening phase is intended to reduce the organic loading so that chemical-oxidant costs and detention time in the oxidation zone may be held to a minimum. The chemical oxidants (H₂O₂, Cl₂, and O₃) will be introduced into a rapid mix zone followed by a mixing baffle detention zone to allow contact time for oxidation of the organic material. The dissolved air flotation unit will be operated at recycle rates from 5 percent to 30 percent of total flow and from 40 to 80 psig air pressure. These data will be utilized to design and demonstrate the flow-through system of a MGD capacity to be evaluated in Milwaukee, Wisconsin.

RESEARCH TASK/PROJECT TITLE Design, Construction, Operation and Evaluation of Rotating Biological Contactor for Waste Treatment			FY 1973 TASK NUMBER 21AAH 0418	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Allis Chalmers Milwaukee, Wisconsin For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Darwin Wright, Systems Con. & Oper. Sec. EPA, 1901 N. Ft. Myer Dr., Xerox Building Arlington, Virginia 20460		
BEGINNING DATE 9/28/67	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$416,526 (67)	

TASK/PROJECT DESCRIPTION AND REPORTS

A Rotating Biological Contactor (RBC) was installed at the Milwaukee Metropolitan Sewerage Commission treatment plant at Jones Island, to demonstrate the feasibility of treating municipal waste with an RBC system. The RBC system effectively treated domestic sewage at high loading rates. Ninety percent COD removal was attained at a loading of 350 to 400 pounds of COD per day per thousand cubic feet of disc volume. Pounds of COD removed increased with pounds of COD applied. Efficiency of treatment improved with increased retention time. Percent BOD removal was approximately five percent greater than percent COD removal. Lower disc speed resulted in a slightly lower efficiency. Lower strength wastes are not as efficiently treated as higher strength wastes at the same organic loading. Recovery from high hydraulic loading is rapid.

RESEARCH TASK/PROJECT TITLE East Chicago Treatment Lagoon			FY 1973 TASK NUMBER 21AAH 0419	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR East Chicago Sanitary District East Chicago, Indiana For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606		
BEGINNING DATE 12/23/66	EST. COMP. DATE 3/23/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,044,120 (67)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to evaluate the effectiveness of treating combined sewer overflow in a very deep detention basin having aerobic and anaerobic levels of treatment. The aerobic treatment is accomplished by large oxygen transfer units suspended on surface of basin waters. The prime objective of the project is to demonstrate a control method to optimize the quality of treatment to storm water and combined sewage mixed with industrial wastewater. This treatment will render a more acceptable discharge to the receiving waters. The demonstration will assess design criteria for detention basins to provide storage and treatment to storm water and combined sewer overflows; design requirements for large oxygen transfer units in relation to volumes of wastewater and quality of effluent.

RESEARCH TASK / PROJECT TITLE Demonstration Project of Biological Absorption of Pollutants from Combined Storm Water Runoff and Sanitary Sewage		FY 1973 TASK NUMBER 21AAH 0421	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR O. Fred Nelson, City of Kenosha 100-51st Place Kenosha, Wisconsin		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 9/10/69	EST. COMP. DATE 6/10/72	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$868,700 (70)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to provide a means for high rate biological treatment of combined sewage by the utilization of viable, activated sludge, clarification and disinfection. The method will be to store sludge in a biosolids reservoir and maintain a contact tank and solids stabilization tank in an empty and ready condition at the sewage treatment plant. When a rain event occurs the excess combined sewage will be directed to the contact tank and the activated sludge proportionally introduced. The tank will be designed to have 15 to 30 minutes contact time. From the contact tank the flow will be directed to a clarifier for solids separation. The effluent will be disinfected and discharged to Lake Michigan with solids returned to the solids stabilization tank and reused or wasted to the digesters.

RESEARCH TASK / PROJECT TITLE Stormwater Treatment Facilities		FY 1973 TASK NUMBER 21AAH 0424	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR City of Dallas, 210 City Hall Main and Harwood, Dallas, Texas 75201 For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert Hiller, Region VI, EPA, 1600 Patterson Street Dallas, Texas 75202	
BEGINNING DATE 6/21/68	EST. COMP. DATE 6/21/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,093,360 (68)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to design, construct, and evaluate a facility to treat overflows from sewers carrying a mixture of domestic wastewater and infiltration stormwater. Physical features include a diversion structure, pumping station, flocculation and sedimentation basins, chemical feed facilities, and a pipeline for conveyance of waste lime sludge from the municipal water treatment plant to the overflow treatment facility. Treatment Unit No. 1 will include flocculation, sedimentation and polishing treatment with tube-type clarifiers; Unit No. 2 will include flocculation and sedimentation; Unit No. 3 will include high-rate sedimentation. Effluent from the facility will be chlorinated. Design flow rate will be 28 million gallons per day. The facility will be operated and evaluated as a demonstration project for a period of one year following completion of construction.

RESEARCH TASK / PROJECT TITLE Large Scale Demonstration of Treatment of Storm-Caused Overflow by the Screening Method			FY 1973 TASK NUMBER 21AAH 0425	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Paul Brunner City of Fort Wayne, 308 East Beery Street Fort Wayne, Indiana 46802			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 4/29/71	EST. COMP. DATE 11/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,067,000 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to install rotating fine screens for the purpose of removing solids from combined sewer overflows prior to discharge to a retention basin for further treatment with effluent from the city's secondary treatment plant. Disinfection will be provided. Detailed evaluation of the treatment process would be carried out.

RESEARCH TASK / PROJECT TITLE Disinfection/Treatment of Combined Sewer Overflows - Syracuse, New York			FY 1973 TASK NUMBER 21AAH 0426	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Frank Drehwing, O'Brien & Gere Engineers, Inc. 1050 W. Genessee Street Syracuse, New York			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Field Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 7/30/71	EST. COMP. DATE 7/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,104,984 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the prevention of pollution of Lake Onondaga caused by enteric organisms in combined sewage discharge. The treatment proposed is fine screening and oxidation/disinfection at selected stationary, sequential, microstrainer and high speed rotary. There will also be a solids/liquid separation utilizing the vortex separator. Disinfection will be evaluated utilizing gaseous chlorine and chlorine dioxide generated on site, by a new and improved technique. Dosage, points of application, aftergrowth, and other factors in kill efficiency, will be carried out. A special virus disinfectant study will also be included in the project.

For Grantee: Onondaga County Department of Public Works
650 W. Hiawatha Blvd., Syracuse, New York 13202

RESEARCH TASK / PROJECT TITLE Demonstration of Screening/Dissolved-Air Flotation Treatment as an Alternate to Combined Sewer Separation			FY 1973 TASK NUMBER 21AAH 0427
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Honorable Kenneth L. Huck, City of Racine 730 Washington Avenue Racine, Wisconsin 53404		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 6/24/70	EST. COMP. DATE 8/24/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,046,039 (70)

TASK / PROJECT DESCRIPTION AND REPORTS

A 700-acre drainage area in the City of Racine, Wisconsin, has a total of 53 outfalls on a four-mile stretch of the Root River. Of these outfalls, 17 are separate storm sewers and 36 are combined sewer overflow relief points. Several outfalls will be intercepted and the flows directed to five riverside treatment units, of which three will treat combined sewage, one will treat storm water only, and one will treat both. The untreated excess combined sewage and urban runoff produce high shock loads on the receiving water during rain events or snow melt. Rather than separation of the combined systems, an alternate of treating the sewage by screening down to 200 microns then flocculation and flotation with pressurized dissolved-air will be demonstrated. There will also be verification of a recently developed combined sewer/water quality mathematical model.

RESEARCH TASK / PROJECT TITLE Humbolt Avenue Overflow Detention and Chlorination Facility			FY 1973 TASK NUMBER 21AAH 0506
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Herbert Goetsch, Public Works City of Milwaukee, 841 North Broadway Milwaukee, Wisconsin 53202		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley, Jr. Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 10/15/66	EST. COMP. DATE 7/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$1,468,589 (67)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate effectiveness of a detention tank and chlorination facilities for the treatment of combined sewer overflows. The tank influent will be screened. Design of tank is based on a 15 minute detention time for sedimentation and chlorination. After overflows, the sludge deposits and wastewater will be pumped back to the existing treatment plant. Aside from typical testing, the evaluation will include river monitoring.

RESEARCH TASK/PROJECT TITLE A Combined Sewerage Collection and Treatment Facility		FY 1973 TASK NUMBER 21AAH 0507	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR City of Mt. Clemens Mt. Clemens, Michigan For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Lawrence O'Leary Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606	
BEGINNING DATE 2/28/68	EST. COMP. DATE 10/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$500,250 (68)

TASK/PROJECT DESCRIPTION AND REPORTS

Overflows from combined sewers cause pollution of the Clinton River during wet weather periods. The objective of this project is to demonstrate the feasibility of controlling such pollution by constructing three aerated "Lakelets" to serve as treatment units. The "Lakelets" will be equipped with surface aerators and operated in series. Effluent from the first two ponds will be subjected to chemical treatment and microstraining, with the final effluent from the third pond receiving similar treatment and chlorination prior to discharge to the Clinton River. This project will explore the potential of the "Lakelets" as recreation facilities for boating and fishing as a part of park operation.

RESEARCH TASK/PROJECT TITLE Systems Approach to Combined Sewer Storm Water Overflow Pollution Abatement		FY 1973 TASK NUMBER 21AAH 0509	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR City of Shelbyville Shelbyville, Illinois For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ralph Christenson Region V, EPA, 1 North Wacker Drive Chicago, Illinois	
BEGINNING DATE 3/30/67	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$440,000 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate a systems approach to pollution abatement. The effectiveness of treating combined sewer overflows from small drainage areas in three types of detention and treatment units will be evaluated. These individual units will be coordinated into a total control system for the community. Units to be installed and evaluated under this project include:

1. a storm overflow lagoon, designed for five-day detention of a ten-year storm, followed by primary and secondary stabilization lagoons will receive flow from 95 percent of the drainage area;
2. a storm overflow lagoon designed for 600 percent of dry weather flow; and
3. a primary storm holding tank for 600 percent of dry weather flow for two-hour detention and equipped with a chlorinator, comminutor solids collecting facilities and a lift station to pump sludge to the treatment plant.

RESEARCH TASK/PROJECT TITLE Treatment of Peak Wet Weather Wastewater Flows and Rate Control of All Wastewater Discharges to Interceptor Sewers			FY1973 TASK NUMBER 21AAH 0521
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *John A. Veogtle, YODER/ORWB Associates 1900 Olympic Boulevard, Walnut Creek, California 94596		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William Bishop Region IX, EPA, 100 California Street San Francisco, California 94111	
BEGINNING DATE 10/1/69	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$359,568 (70)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to construct a combined sedimentation and equalization pond to include a unique sludge collection system for use as an aerator during dry weather. Excess flows from the pond will be delivered to a storage and chlorination pond (existing oxidation pond) and released after a two-day detention and chlorination.

*For Grantee: City of Rohnert Park
Rohnert Park, California

RESEARCH TASK/PROJECT TITLE The Somerville Marginal Conduit Including Pretreatment Facilities			FY1973 TASK NUMBER 21AAH 0522
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *George Earle Charles A. Maguire, Assoc., 178 Tremont Street Boston, Massachusetts 02111		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William Butler Region I, EPA, John F. Kennedy Building Boston, Massachusetts 02203	
BEGINNING DATE 8/31/70	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$452,000 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop, demonstrate and evaluate treatment method for excess combined sewage. The treatment will consist of screening and chlorination. A suitable screening technique will be developed. The chlorination process will involve new and improved utilization of high current density electrolytic process to generate a sodium hypochlorite solution for disinfection of combined sewage. The construction will be coordinated with adjacent highway construction and drainage and recreational water protection.

*For Grantee: Metropolitan District Commission
20 Somerset Street, Boston, Massachusetts

TREATMENT OF STORM WATER DISCHARGES

RESEARCH TASK/PROJECT TITLE Chlorination and Hypochlorination of Polluted Storm Water Pumpage			FY 1973 TASK NUMBER 21AAI 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Sewage and Water Board of New Orleans New Orleans, Louisiana For information, contact Project Officer		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert Hiller Region VI, EPA, 1600 Patterson Street Dallas, Texas 75202		
BEGINNING DATE 12/2/66	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$1,034,290 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to control bacteriological pollution in Lake Pontchartrain. This project will demonstrate the effectiveness, efficiency, and economics of using open drainage canals as treatment facilities; the effectiveness of chlorine and hypochlorite disinfection on intermittent high flow discharges; and the optimization of various feeding rates, multiple points of application, and contact time. Facilities for disinfection will be placed, evaluated, and operated in the St. Charles Canal, the London Avenue Canal, and the Orleans Avenue Canal. A sodium hypochlorite blending plant will be constructed and a chlorine alarm system installed. This project will include the provision of appropriate instrumentation for the generation of quantitative and qualitative data necessary for a comprehensive evaluation.

RESEARCH TASK/PROJECT TITLE Characterization and Disposal of Combined Sewer Overflow Sludges and Solids			FY 1973 TASK NUMBER 21AAI 20	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Anthony Geinopolos, Managing Associate Environmental Sciences Div., Envirex Inc. P. O. Box 2022, Milwaukee, Wisconsin 53201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Anthony N. Tafuri Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE 4/15/73	EST. COMP. DATE 4/15/74	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$99,240

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to: (1) characterize the residual sludges arising from the treatment (physical, physical-chemical, and bio-chemical) of combined sewer overflows; and (2) develop promising alternative sludge handling/disposal treatment process flow sheets and an engineering evaluation of the alternative flow sheets developed.

The project objectives will be met through the conduct of various work tasks consisting of the following: (1) desk top analysis/reviews to obtain any available data regarding handling and disposal of sludges; type and size of CSO control/treatment systems, hydrological data and available data regarding the dry weather flow and treatment; (2) investigations at selected sites to supplement available information by conducting sludge sampling programs to determine and evaluate the sludge characteristics of each sludge generating process; bench scale sludge handling and disposal treatment tests to determine their treatment amenability; obtain basic design criteria for engineering design purposes; and (3) development of promising alternative sludge handling/disposal treatment process flow sheets and an engineering evaluation of the alternative flow sheets developed.

A final report will entirely document the above work tasks and provide engineering recommendations for the design of a treatment system for the handling/disposal of CSO sludges.

TECHNOLOGY FOR CONTROL OF POLLUTION CAUSED BY URBAN NON-SEWERED RUNOFF

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Characterization and Treatment of Urban Land Runoff			21AAJ 0203
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Newton Colston, Water Resources Research Institute University of North Carolina, 124 Riddick Building Raleigh, North Carolina 27607		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Anthony N. Tafuri Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/71	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$106,672 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

A 1.67 square mile drainage area in Durham, North Carolina, will be monitored over a two-year period, for the purpose of correlating storm water discharge quality with land use, rate of flow, storm characteristics, and runoff time; laboratory pilot-scale studies will be conducted to evaluate the applicability, effectiveness, and economics of sedimentation and physiochemical treatment of storm water discharges. Water quality management criteria will be developed to evaluate the relationship of storm water discharge control/treatment versus advanced municipal waste treatment, in terms of cost and effectiveness to meet desired water quality levels.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Urban Runoff Pollution from Motor Vehicles			21AAJ 0204
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Gil Levin, Inc. Enterprises, Incorporated 4028 W. ville, Maryland ...		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Francis J. Condon (EPA, Arlington, Va.) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
4/24/72	10/24/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$218,200 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The project is to provide first-line data on the specific contribution of motor vehicles to highway dust, dirt, solubles and other deposits, which eventually become pollutants in street stormwater runoff.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Study of the Environmental Impact of Highway Deicing			21AAJ 0305/0405
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR David L. Richardson, Arthur D. Little, Inc. 25 Acorn Park Cambridge, Massachusetts 02140		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER H. E. Masters Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/26/72	6/30/74	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$197,975 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

Recommendations to reduce pollution hazards created by the use of deicing chemicals will be incorporated into two manuals addressed to the use and storage of these chemicals. A Deicer Users Manual will describe improved snow and ice removal practices, optimum systems for applying deicing chemicals to streets and highways and will recommend the absolute minimum amounts necessary to maintain safe traffic flow. A second manual, for the storage and handling of deicing chemicals will include design and siting recommendations for storage facilities.

In preparing both manuals, the contractor will consult equipment manufacturers, the salt industry, and federal, state, and municipal agencies as well as Canadian, European, and British organizations responsible for the use of deicing compounds. They will also observe and take into consideration, the policy framework within which highway departments must operate.

In addition, an examination of the ecological effects of continued dumping of enormous quantities of snow from streets and highways into nearby water bodies or onto water supply watersheds. Several sites will be selected within the snowbelt states for field studies to determine the characteristics of the snow being dumped. Recommendations will be made where existing snow removal practices are considered environmentally unacceptable.

NON-SEWERED DOMESTIC WASTES 1B2035

OUTPUT: Demonstration of technology for the effective and economical control of pollution from non-sewered wastes so that municipal and rural sectors lacking conventional gravity collection systems will be able to upgrade their treatment capabilities to achieve compliance with present and future water quality standards. Program efforts will be to: (1) demonstrate flow reduction devices for the individual home; (2) develop and demonstrate improved home treatment systems; (3) examine economically feasible alternatives to existing septic tank systems; and (4) demonstrate intermediate systems between conventional sewers and individual systems.

DEVELOP ECONOMICALLY-FEASIBLE TREATMENT AND DISPOSAL SYSTEMS
FOR DIFFUSE POPULATION AREAS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Economical Residential Pressure Sewage System with No Effluent			21AAE 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Gerald F. Hendricks, President SIECO, Inc., 931 5th Street Columbus, Indiana 47201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
4/1/69	4/1/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$65,919

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to demonstrate that septic tank effluent can be treated by a combined anaerobic and aerobic lagoon without objectionable odors and show that the lagoon effluents containing nutrients can be converted to vegetation at reasonable costs, and to provide a community pressure sewer system that will demonstrate the volumetric reduction advantage in a tight pressure sewage system, the cost advantage of plastic pipe sewerage system, maintenance and power cost of grinding and pumping units by individual users.

The project has been completed and a final report is being prepared.

*For Grantee: Grandview Lake Lot Owners Association
RR#6, Columbus, Indiana 47201

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Pressure Sewer Demonstration			21AAE 02(a)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Daniel O. Ramos, Project Engineer RESD General Electric Company Philadelphia, Pennsylvania 19101		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
10/1/70	2/1/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$80,142 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the feasibility of a pressure sewer system using individual home pump-grinder units. The pump-grinder unit will be installed in each of five homes. The sewage from the homes will be ground and pumped through a common pipe to an existing gravity sewer. The plastic pipe will run about one-half mile and experience a net elevation rise of sixty feet. The system will be evaluated over a six-month period.

The project has been completed and a final report is being prepared.

*For Grantee: Borough of Phoenixville
140 Church Street, Phoenixville, Pennsylvania 19460

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Develop Methodology for Disposing of Wastes from Non-Sewered Sources		21AAE 09	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	7/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$37,500

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to determine feasible methods for the safe and non-polluting disposal of waste from septic tanks, pit-type tanks, and holding tanks.

A two month literature survey has been completed to determine current problems and treatment methodology. Simultaneously, such wastes as are presently being discharged into the Lebanon Sewage Treatment Plant have been characterized chemically, physically, and biologically. Tests have shown that these materials primarily septic tank wastes, are extremely variable in character. Settling and thickening tests with and without chemical addition and/or mechanical stirring have shown that there is generally little potential for gravity thickening. Lime stabilization followed by sand bed dewatering is currently the treatment method believed to have the greatest potential. Tests will begin in February 1973.

Other approaches to be considered are bleeding of the waste from a holding tank through the conventional activated sludge process, introducing the waste into the main plant under various waste/plant flow ratios, and evaluating possible pretreatment methods. Special attention will be devoted to the effect of metals upon the activated sludge process.

HEAVY INDUSTRIAL SOURCES

1B2036

OUTPUT: New or improved methods for the abatement of water pollution caused by the discharge of wastes from heavy industries. These industries include, but are not limited to, metal and metal products, chemicals and allied products, nuclear and fossil fuel power production, petroleum and coal products, machinery and transportation equipment manufacturing, textile mill products, and rubber and plastic products, in addition to any joint industrial/municipal waste sources. Program effort will be directed to achieve, at minimum cost, the equivalent of 85 and 99 percent removal of contaminants and the technology to achieve closed loop systems for water reuse. Emphasis will be placed on advanced technology full-scale plant systems.

UPDATING STATE-OF-THE-ART AND DEVELOPMENT OF PRETREATMENT AND PRACTICABLE
TECHNOLOGY TO ACHIEVE 95% POLLUTANT REDUCTION FOR THE MISCELLANEOUS CHEMICALS
MANUFACTURING AND FORMULATING INDUSTRIES, SIC 2851, SIC 2815, SIC 283, SIC 284, SIC 286, SIC 289

RESEARCH TASK / PROJECT TITLE Armour Industrial Chemical Company Secondary Wastewater Treatment			FY 1973 TASK NUMBER 21AEV 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *E. F. Harp, Director of Engineering Armac Co., P. O. Box 1805 Chicago, Illinois 60690		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Clifford Risley Region V, EPA, 1 North Wacker Drive Chicago, Illinois 60606		
BEGINNING DATE 10/6/69	EST. COMP. DATE 12/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$210,000 (70)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to develop and demonstrate a secondary treatment biological process to reduce the effluent from a fatty acid derivatives chemical plant to less than 100 ppm of hexane soluble materials. Development work includes the evaluation of an existing pilot-plant test unit, to be followed by a full-scale (0.5 mgd) demonstration at the Armour plant in McCook, Illinois. The treated effluent water quality improvement, obtainable by use of a tertiary treatment process, will also be explored on a pilot scale.

Initial use of the system led to the development of undesirable odors. Attempts to control these odors by careful control of the treatment system were unsuccessful and odor control equipment is now being installed.

*For Grantee: Armour Industrial Chemical Company
Chicago, Illinois 60611

RESEARCH TASK / PROJECT TITLE Waterborne Wastes of the Paint and Pigments Industries			FY 1973 TASK NUMBER 21AEV 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William Barrett, Head, Environmental Chemistry Division Southern Research Inst., 2000 Ninth Avenue Birmingham, Alabama 35205		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Herbert S. Skovronek Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE 6/20/72	EST. COMP. DATE 3/19/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$33,000 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

1. Characterize the industry for production and pollution purposes (i.e., size, age, product, or products, manufacturing processes).
2. Characterize the industry wastewaters - raw waste loads and other unique problems, for (1) above.
3. Identify or define and assess the best practicable treatment technology in terms of operating characteristics and cost.
4. Identify or define and assess the best available treatment technology in terms of operating characteristics and cost.
5. Identify or define and assess pretreatment technology for discharge to municipal systems, in terms of operating characteristics and cost where applicable.
6. Identify the R&D needed to achieve a "closed loop" wastewater control system or the elimination of pollutional discharges.

RESEARCH TASK / PROJECT TITLE Characterization of Wastewaters from the Pharmaceutical Industry			FY 1973 TASK NUMBER 21AEV 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John S. Ruggiero, Vice President Pharmaceutical Manufacturers' Association 1155 15th Street, N.W., Washington, D.C.		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Herbert S. Skovronek Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 9/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$33,938

TASK / PROJECT DESCRIPTION AND REPORTS

1. Characterize the pharmaceutical industry for production and pollution purposes.
2. Characterize the industry wastewaters - raw waste loads and other unique problems.
3. Identify or define and assess the best practicable treatment technology in terms of operating characteristics and cost.
4. Identify or define and assess the best available treatment technology in terms of operating characteristics and cost.
5. Identify or define and assess pretreatment technology for discharge to municipal systems, in terms of operating characteristics and cost where applicable.
6. Identify the R&D needed to achieve a "closed loop" wastewater control system for the elimination of polluttional discharges.

RESEARCH TASK / PROJECT TITLE Biological Oxidation and Chemical Coagulation of Dyestuff and Organic Chemical Wastes			FY 1973 TASK NUMBER 21AEV 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Erwin J. Eccles, Research Chemical Engineer Southern Dyestuff Company, P. O. Box 10098 Charlotte, North Carolina 28201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edmond Lomasney Region IV, EPA, 1421 Peachtree St., N.E. Atlanta, Georgia 30309	
BEGINNING DATE 2/26/71	EST. COMP. DATE 7/26/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$501,122 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The grantee will design, construct, operate, and evaluate a waste treatment system for the control of wastes from a textile dyestuff and organic chemicals plant. The plant produces over 200 different dyestuff products and more than 40 aromatic organic chemicals. The plant will be designed to handle a flow of 2.2 mgd with a BOD of 760 mg/l, a COD of 1750 mg/l, suspended solids of 350 mg/l, and a high color content. The waste treatment system consists of biological decomposition of a thiosulfate waste stream, pH control of acid and alkaline waste streams, and biological oxidation, coagulation and clarification of the combined wastes. The system will be operated for a 12-month period in order to determine the unit process operating parameters and system characteristics.

In addition, pilot-plant studies will be conducted to determine the basic design factors needed to upgrade the system's treatment capabilities for color removal.

DEVELOP TECHNOLOGY TO ACHIEVE RECYCLE, REUSE AND CLOSED LOOP CAPABILITY FOR THE
MISCELLANEOUS CHEMICALS MANUFACTURING AND FORMULATING INDUSTRIES,
SIC 2851, SIC 2816, SIC 2815, SIC 283, SIC 284, SIC 286, SIC 289

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
The Reclamation of Sulfuric Acid from Waste Streams		21AEX 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR H. C. Peterson, Manager of Development New Jersey Zinc Company Palmerton, Pennsylvania 18071		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Herbert S. Skovronek Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/30/72	5/29/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$149,560 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The project provides for the design, construction, installation, operating, testing, evaluation, and reporting on the effectiveness of a pilot plant system for the total evaporation and partial reconcentration of waste sulfuric acid generated by hydrolysis of sulfuric acid digestion liquor during TiO₂ pigment manufactured by the sulfate process. Removal of the contaminant salts from the vaporized acid stream by a cyclone separator will also be evaluated. Problems of sulfuric acid mist and sulfur dioxide generation will be explored and corrective measures implemented if necessary. Based on the results of the pilot plant study, a full scale system will be designed and projected "full scale" economics of the procedure determined.

The applicability of the total vaporization system to other waste acid streams, specifically spent pickle liquor, will also be studied using the pilot plant equipment.

DEVELOP ADVANCED WASTE TREATMENT TECHNOLOGY FOR THE
METAL FINISHING, MACHINERY AND TRANSPORTATION EQUIPMENT INDUSTRIES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Destruction of Cyanide Wastes by an Electrochemical Redox Process			21AHN 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Raymond Tonks, President & General Manager Aerodex, Inc., P. O. Box 123 Miami, Florida 33148			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edmond Lomasney Region IV, EPA, 1421 Peachtree Street, N.E. Atlanta, Georgia 30309	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/1/71	7/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$85,072 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

This project involves the development and demonstration of an electrochemical waste treatment process for destroying cyanide in metal finishing rinse waters. The study consists of a pilot plant investigation, the design of a continuous system based on optimized parameters, and a full scale demonstration to determine the effectiveness and economics of the process.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Electrolytic Treatment of Job Shop Metal Finishing Wastewaters			21AHN 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Bruce E. Warner, President New England Plating Co., Inc. Worcester, Massachusetts 01605			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John Cincia Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/1/71	12/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$119,424 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

This project involves the demonstration of a new carbon-bed electrolytic system consisting of three cells for treating cyanide-bearing rinse waters and four cells for treating chromium bearing rinse waters in a large metal finishing job shop. The cyanide is electrolytically oxidized to cyanate or carbon dioxide and nitrogen, and the hexavalent chromium is reduced to the trivalent form which is amenable to precipitation with alkali. The treatment also includes the use of tube settlers for removing the metal precipitates from the effluent of the electrolytic system and a centrifuge for dewatering and concentrating the sludge.

DEVELOP TECHNOLOGY TO ACHIEVE RECYCLE, REUSE AND CLOSED LOOP CAPABILITY FOR THE
METAL FINISHING, MACHINERY AND TRANSPORTATION EQUIPMENT INDUSTRIES

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Use of Reverse Osmosis for Treating Metal Finishing Effluents			21AHO 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Lee Rozelle, Director of Chemistry Civ., North Star Research & Dev. Inst., 3100 Thirty-Eighth Avenue South Minneapolis, Minnesota 55406			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Hugh Durham (Grosse Il. Field Sta., Mich.) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
5/1/72	1/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$75,860 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop reverse osmosis membranes for the treatment of the various types of rinse waters discharged from metal finishing facilities. The reverse osmosis system provides pollution control, rinse water reuse, and concentration of the chemicals for return to the metal finishing bath. Of particular interest are membranes that can withstand high and low pH as well as oxidizing conditions.

*For Grantee: Minnesota Pollution Control Agency
717 Delaware St., S.E., Minneapolis, Minnesota 55440

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Recovery of Chromic Acid and Nickel from Plating Wastes			21AHO 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR C. W. Gross, President & General Manager Michigan Plating & Strapping Co., 740 Ann Ave., N.W. Grand Rapids, Michigan 49502			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☐ PROJECT OFFICER Hugh B. Durham (Grosse Il. Field Sta., Mich.) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
3/1/71	12/31/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$170,061 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

This project involves the demonstration of a metal finishing waste abatement system consisting of: (1) integrated nickel and chromium chemical wash treatment; (2) electrolytic recovery of nickel from the sludge produced in the nickel integrated treatment process; and (3) evaporative recovery of chromic acid from save rinse and fume scrubber waters. The system will overcome the sludge disposal problems encountered with conventional chemical treatment and permit the reuse of the bulk of the wastewater.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Membrane Processes for Treating Metal Finishing Wastes			21AHO 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Robert Goldsmith, Program Mgr. of Membrane R&D Abcor, Inc., 341 Vassar Street Cambridge, Massachusetts 02139		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John Ciancia Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
10/15/71	10/31/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$114,386 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the technical feasibility and determine the economics of reverse osmosis for treating metal finishing rinse waters by recovery of the chemicals and reuse of the water. The project involves an in-house pilot plant investigation at the subcontractor's (Abcor, Inc.) facility on various types of rinse waters for evaluation of membrane properties and equipment configurations, effectiveness of treatment, operating parameters and removal of impurities where necessary to achieve closed-loop treatment. The project also includes the demonstration of a selected system in an actual metal finishing shop to evaluate the treatment concept under actual plant conditions.

*For Grantee: American Electroplaters' Society, Inc.
 56 Melmore Gardens, East Orange, New Jersey 07107

UPDATING STATE-OF-THE-ART AND DEVELOPMENT OF PRETREATMENT AND
PRACTICABLE TECHNOLOGY TO ACHIEVE 95% POLLUTANT REDUCTION FOR THE
PLASTICS AND RUBBER INDUSTRIES, SIC 2821, SIC 30 and SIC 2822

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
State-of-the-Art Effluent Study of the Rubber Industry			21AIB 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Dan Pennington, Gov't. Relations Assoc. Rubber Mfgs. Association, 444 Madison Avenue New York, New York 10022		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Herbert S. Skovronek Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/1/72	2/28/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$29,518	

TASK / PROJECT DESCRIPTION AND REPORTS

The Rubber Manufacturers' Association (RMA), with the assistance of a consultant, will report on the nature and characteristics of the water pollution problem and the State-of-the-Art for control technology for the rubber and rubber products industry. The scope of work for the project proposes documentation of 5 segments of the industry as defined by the Standard Industrial Classifications 2822, 3011, 3021, 3031, and 3069. The project requires the development and documentation of information to satisfy the following problem areas: (1) classification of the industry for production and pollution purposes; (2) characterization of industry wastewaters with reference to classifications in (1); (3) identification, definition and assessment of the wastewater management techniques that are available and in use; and (4) identification of the research and development needed to achieve a water reuse capability.

DEVELOP TECHNOLOGY TO ACHIEVE RECYCLE, REUSE, AND CLOSED LOOP CAPABILITY FOR THE
PLASTICS AND RUBBER INDUSTRIES, SIC 2821, SIC 30, AND SIC 2822

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Industrial Wastewater Renovation Plant, the General Tire and Rubber Company			21AID 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John H. Crozier, Chemical Engineer The General Tire and Rubber Company Odessa, Texas			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph Field Region VI, EPA, 1600 Patterson Street Dallas, Texas 75202	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
12/30/70	6/30/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$461,690 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The project is to demonstrate the applicability of a vertical tube evaporator (VTE) distillation plant for the renovation of organics containing industrial wastewater. The chemical waste effluent emanating from the General Tire and Rubber Company Synthetic Rubber Plant, Odessa, Texas, at rates up to 750,000 gpd, contains dissolved solids, mostly sulphates and chlorides, in concentrations up to 7,000 ppm in addition to organics in excess of 100 ppm. The proposed VTE plant will be used to obtain high quality water for reuse. The residual concentrated brine will be disposed of by means of the existing 90-acre pvc-lined evaporation ponds.

This grant is intended to demonstrate the applicability of VTE to the renovation of organics containing industrial waste effluents providing high quality recycle water and the substantial reduction of the waste for ultimate disposal to a practical volume.

Extensive problems due to fouling and corrosion have now been attributed to sulfides in the influent. Pretreatment by trickle filter to oxidize these sulfides is now being evaluated.

TOTAL ENVIRONMENTAL PROTECTION WITH EMPHASIS ON TREATMENT,
DISPOSAL OR RECOVERY OF PRODUCTS FROM METAL FINISHING SLUDGES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Reclamation of Metal Values from Metal Finishing Waste Treatment Sludges			21ARD 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *G. Ray Smithson, Chief of Waste Cont. & Proc. Tech. Battelle Columbus Laboratory, 505 King Avenue Columbus, Ohio 43201			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Eugene Harris Edison Water Quality Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
10/6/70	1/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$90,069 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop information on sludge volumes and characteristics produced in metal finishing plants, determine the effects of weathering on sludges in current disposal practice, and carry out bench-scale investigations on potentially attractive techniques for recovering metals from these sludges. On the basis of the investigation, the process design and economics will be determined for selected metal recovery systems.

*For Grantee: Metal Finishers' Foundation
 248 Lorraine Avenue
 Upper Montclair, New Jersey 07043

TRANSPORTATION SOURCES

1B2038

OUTPUT: Technology for the development of efficient and practical devices for the detection and prevention of pollution of the marine environment by watercraft (and other transportation sources) so as to enable industry to meet forthcoming and/or established standards. Program efforts will be concentrated on such pollutants as sanitary wastes, chemicals, oils, bilge waters, ballast waters, wash water and engine exhaust. This program will provide the necessary research to develop and evaluate prototype shipboard detection and antipollution devices, and prototype supporting onshore dockside facilities.

DEVELOP AND DEMONSTRATE SANITATION DEVICES FOR VESSELS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Device for On-Board Treatment of Wastes from Vessels			21APK 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John E. McWade, Gulf & Western Ind. Products Company 101 Chester Road Swarthmore, Pennsylvania 19081		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Bernard Hornstein Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/71	3/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$106,269 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to design, develop and demonstrate a compact, simple to operate, sanitary waste treatment system for handling 15 man days (3 x 5 or 5 x 3) of waste from existing marine heads before filter replenishment.

Phase I development program is for experimental verification of the Clarke's Carbon treatment for sanitary waste followed by filtration. Reportedly, the system produces an effluent closely approaching drinking water quality. Any finely divided activated carbon will suffice, but superior performance is reported for the Clarke's Carbon system.

Phase II proposes installation and demonstration on a 34 foot sailing vessel.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Development and Demonstration of Device for On-Board Treatment of Wastes from Vessels			21APK 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR W. B. Johnson, AWT Systems, Inc. 910 Market Street Wilmington, Delaware 19899		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Bernard Hornstein Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/71	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$223,125 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

This project is to design, develop and demonstrate a compact modular system for all wastes from pleasurecraft. The system utilizes pressure filtration, carbon adsorption, incineration and vapor phase catalytic and chlorination oxidation. The components of the system can be designed such that a treatment device may consist of from one to four modules, depending on space and weight limitation of vessels. Phase I, the laboratory phase, will consist of developing and testing the individual components. Following the lab phase, a prototype system will be assembled for vessel installation and demonstration.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Device for On-Board Treatment of Wastes from Vessels			21APK 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. A. Remus, General American Trans. Corporation 7449 North Natchez Avenue Niles, Illinois 60648		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER David J. Cesareo Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/30/71	3/30/73	☒ Contract ☐ Grant ☐ Intramural		Federal Cost: \$137,800 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

This project is to design, fabricate and test a system for treating sanitary and galley wastes from vessels with a 6 to 20 man crew.

The unique feature of the proposed system is the incorporation of a hydrophilic filter consisting of a screen and "sponge" to accomplish solids-liquid separation.

A Phase I, 9 month period is included for development of full-scale system and laboratory testing. A Phase II period includes installation onboard a vessel for performance testing.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
R/V Alcoa Sea Probe Sewage Treatment Plant			21APK 12	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR D. R. Froehlich Ocean Science & Engineering, Inc. 3 Choke Cherry Road Rockville, Maryland 20850		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
7/30/70	2/28/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$33,669 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The project is intended to demonstrate the effectiveness of a closed circuit recirculating flush system designed to preclude any overboard discharge from the sanitary facilities while the vessel is in port or in restricted waters. Involved is chemical treatment, separation of solids and recirculation of sterile flushing liquid.

Included is the modification of an existing design of an onboard sewage treatment plant to suit a special purpose vessel of 2000 tons displacement and 50 person crew.

Shipyard installation of the system and auxiliary equipment during construction of the ship; initial test and checkout of the plant; acquisition of operational data related to suitability of application; and final report are required. The report will present results, conclusions and recommendations covering installation efforts, operation aspects, costs, and chemical and biological effectiveness.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Device for On-Board Treatment of Wastes from Vessels			21APK 13	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. M. Chamberlin, Westinghouse Electric Corporation R&D Center, Beluah Road Pittsburgh, Pennsylvania 15235		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/30/71	6/30/73	☒ Contract ☐ Grant ☐ Intramural		Federal Cost: \$157,000 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop and test a small, reliable recirculating waste treatment system for small pleasure craft up to 26 feet in length. The system will be designed to treat the waste generated by four people and will fit into a space of 20 cubic inches.

All of the components, with the exception of an incinerator, have been evaluated in Westinghouse Research Laboratories. The components of the proposed system include: (1) a commode base; (2) a unique moving spring screen solid separator; (3) a liquid reservoir; (4) a solids incinerator; and (5) a disinfecting/chemical treatment device.

The above components will be designed, fabricated and tested in the laboratory using human waste during Phase I. Phase II involves building, installing and testing the device aboard the Westinghouse vessel, "Sea Search."

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Development and Demonstration of a Device for On-Board Treatment of Wastes from Vessels			21APK 14	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Terry McMahan, Ocean Systems, Inc. 11440 Isaac Newton Square North Reston, Virginia 22070		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER David J. Cesareo Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/30/71	9/30/73	☒ Contract ☐ Grant ☐ Intramural		Federal Cost: \$194,590 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The project is intended to demonstrate the effectiveness of a closed circuit recirculating flush system designed to preclude any overboard discharge from the sanitary facilities while the vessel is in port or in restricted waters. Involved is chemical treatment, separation of solids and recirculation of sterile flushing liquid.

Included is the modification of an existing design of an onboard sewage treatment plant to suit a special purpose vessel of 2000 tons displacement and 50 person crew.

Shipyard installation of the system and auxiliary equipment during construction of the ship; initial test and checkout of the plant; acquisition of operational data related to suitability of application; and final report are required. The report will present results, conclusions and recommendations covering installation efforts, operation aspects, costs, and chemical and biological effectiveness.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Recreational Watercraft Waste Treatment System			21APK 16
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Stan Summers, Ametek/Calmech 5825 District Boulevard Los Angeles, California 90040		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/30/71	3/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$119,700 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this program is to design, develop and demonstrate a compact, simple to operate, reliable and relatively maintenance-free physical-chemical waste treatment system for recreational watercraft.

The unique feature of the proposed system is the incorporation of the combined processes of an in-depth filtration and carbon adsorption in a moving bed. An electrically driven, variable pitch screw shaft moves the filtration/adsorption mixed media on an intermittent basis. The active zone of the unit is replenished periodically with fresh media while the spent media is wasted to a storage cannister which requires emptying once per boating season.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Devices for On-Board Treatment of Wastes from Vessels			21APK 18
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Paul D. Nance Thiokol Chem. Corp., P. O. Box 524 Brigham City, Utah 84302		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Leo T. McCarthy, Jr. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/30/71	8/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$149,000 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to design, develop and test a compact, low-cost, highly reliable waste treatment system for sanitary vessel waste with a crew compliment of 10 men. Emphasis on adaptability of the proposed design to both smaller and larger pleasure craft will be included.

The proposed system employs the unique feature of a filter/incinerator developed by Thiokol. As reported by Thiokol for the system performance, the effluent contains less than 50 mg/l of suspended solids and biochemical oxygen demand (BOD) and less than 240 MPN/100 ml of coliform. This quality would more than satisfy the stated objectives of the RFP.

A seven month Phase II demonstration onboard a houseboat is proposed after the Phase I development.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Device for On-Board Treatment of Wastes from Vessels		21APK 19	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. Henderson, Fairbanks Morse, Inc., Research Center 701 Lawton Avenue Beloit, Wisconsin 53611		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER David J. Cesaero Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/30/71	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$241,122 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this program is to design, develop and demonstrate a recirculating sanitary waste treatment device for a crew size of 25, but applicable design changes can expand the treatment capability to 20 to 50 man crew sizes.

The treatment process includes coarse solids separation, coagulation, filtration by means of a moving paper filter, carbon adsorption and chlorination. All solid waste generated, including filter paper and separated solids, will be incinerated.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Marine Sanitation System Demonstration		21APK 21	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *E. L. Kaminsky, Marland Environmental Systems, Inc. 150 Stratford Road Wayne, Pennsylvania 19087		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
5/1/71	2/28/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$138,630 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate a physico-chemical marine sanitation system capable of producing an effluent having characteristics equivalent to a high level of secondary treatment. The vessel selected for the demonstration is a ferry operating between Cape May, New Jersey, and Lewes, Delaware. The proposed process utilizes a centrifuge to separate the solids from the liquid waste followed by a series of carbon adsorption columns to remove the remaining organic contaminants. The liquid effluent from the system can be recirculated through the ferry plumbing system as flush media or discharged overboard. The solids remaining will be collected onboard and will be disposed of on-shore once each week.

*For Grantee: Delaware River and Bay Authority
P. O. Box 71, New Castle, Delaware 19720

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Catalytic Waste Treatment Systems for Great Lakes Ore Carriers		21APK 22	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Paul D. Nance, Thiokol Chem. Corp. P. O. Box 524 Brigham City, Utah 84302		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Leo T. McCarthy, Jr. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/15/71	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$128,218 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The overall objective of this grant is to develop a physicochemical system of treating sanitary, galley, laundry, shower and wash basin wastes generated on an ore carrier operating on the Great Lakes with a crew of 30 men. The proposal envisages using three subsystems. One subsystem, employing a proprietary catalytic-incinerator for solid liquid separation and solids reduction, and proprietary catalytic columns for dissolved solids removal and oxidation, would treat only sanitary wastes. The second subsystem, treating sanitary and galley wastes, would employ a centrifuge for solids, grease, liquid separation; an incinerator for grease and solids reduction and catalytic columns for dissolved solids removal and oxidation. The third subsystem would use electrolytic chlorination to sterilize shower, wash basin and laundry wastewater. These three tanks and automatic controls to treat in excess of 2,900 gallons of waste per day. After fabrication, the subsystems will be assembled on shore and tested before installation on board ship. Upon installation of the subsystems there would be a 90 day shipboard evaluation followed by a 6-month program to evaluate performance reliability. Effluent requirements for the proposed system would be less than 50 mg/l of suspended solids, less than 50 mg/l of BOD and less than 240 MPN of coliform organisms per 10 ml.

*For Grantee: Cleveland Cliffs Iron Company
1400 Union Commerce Building
Cleveland, Ohio 44115

DEVELOP TEST CRITERIA FOR PERFORMANCE EVALUATION AND MARINE SANITATION DEVICES

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Instrumentation for Monitoring of Marine Sanitation Systems			21APN 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR C. E. Mauk Houston Research, Inc., 8330 Broadway Houston, Texas 77017		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
9/15/72	6/30/74	☒ Contract ☐ Grant ☐ Intramural		Federal Cost: \$74,548 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this program is to develop and demonstrate the technology for the effective monitoring of effluents from marine sanitation devices installed onboard recreational vessels. The instrument to be developed will use optical and colorimetric principles for automatic monitoring at a pre-determined standard with provision to alert the boater and inspection personnel when suspended solids exceeds or total chlorine residual is less than the pre-determined standard. The instrument will be tamper proof, easily installed, capable of operating in salt, fresh and brackish flush systems, will be safe to operate and easy to maintain, and will have an uninstalled first cost of less than \$100. The instrument will consist of an optical assembly, electronic circuitry and a sample system which shall be packaged in a compact unit no greater than 12" x 12" x 6" and weigh no more than 5 lbs.

The program includes engineering research to adapt existing instrument principles for suitable operation under shipboard conditions. A prototype instrument will be assembled and laboratory tested using a procedure that simulates the treatment of shipboard waste. The instrument will finally be installed on an EPA approved recreational vessel equipped with a marine sanitation device for onboard testing over a 90 day period to establish reliability, maintenance and operating requirements and accuracy under actual field conditions. A final report will be prepared and distributed summarizing all aspects of the program.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Instrumentation for Monitoring Recreational Watercraft Sanitation Systems			21APN 07(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert A. Mostello, Procedyne Corporation 221 Somerset Street New Brunswick, New Jersey 08903		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
9/15/72	6/30/74	☒ Contract ☐ Grant ☐ Intramural		Federal Cost: \$124,079 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this program is to develop and demonstrate the technology for the effective monitoring of effluents from marine sanitation devices installed onboard recreational vessels. The instrument to be developed will use optical and amperometric principles for automatic monitoring at a pre-determined standard with provision to alert the boater and inspection personnel when suspended solids exceeds or total chlorine residual is less than the pre-determined standard. The instrument will be tamper proof, easily installed, capable of operating in salt, fresh and brackish flush systems, will be safe to operate and easy to maintain and will have an uninstalled first cost of less than \$100. The instrument will consist of an optical assembly, electronic circuitry and a sample system which shall be packaged in a compact unit no greater than 12" x 12" x 6" and weigh no more than 5 lbs.

The program includes engineering research to adapt existing instrument principles for suitable operation under shipboard conditions. A prototype instrument will be assembled and laboratory tested using a procedure that simulates the treatment of shipboard waste. The instrument will finally be installed on an EPA approved recreational vessel equipped with a marine sanitation device for onboard testing over a 90 day period to establish reliability, maintenance and operating requirements and accuracy under actual field conditions. A final report will be prepared and distributed summarizing all aspects of the program.

DETERMINATION OF THE EFFECTS OF OUTBOARD ENGINE EXHAUST
ON THE AQUATIC ENVIRONMENT

RESEARCH TASK / PROJECT TITLE Analysis of Pollution from Marine Engines and Effects of the Environment			FY 1973 TASK NUMBER 21APO 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Matt Kaufman, Boating Industry Association 333 North Michigan Avenue Chicago, Illinois 60601		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Leo T. McCarthy, Jr. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 4/13/71	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$199,220 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to obtain sufficient laboratory and field data to be able to predict the number of outboard engines which can be operated on any particular body of water without causing adverse effects on the aquatic environment. The project is divided into two phases. The first phase will assess the extent of ecological disturbance caused by the operation of outboard motors and will determine the affect on the aquatic system food chain. This phase will be conducted in natural aquatic systems in both northern and southern climates. The second phase consists of a laboratory investigation to identify and quantify the major components of submerged exhaust emission from outboard engine variations due to engine horsepower, manufacturer's design, engine age and maintenance.

RESEARCH TASK / PROJECT TITLE Effects of Exhausts from Two-Cycle Outboard Engines			FY 1973 TASK NUMBER 21APO 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William W. Shuster Rensselaer Polytechnic Institute Troy, New York 12181		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Royal J. Nadeau Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 7/1/71	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$84,300 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The proposed project would investigate levels of outboard engine discharges that exist under a variety of use patterns in an oligotrophic/mesotrophic lake as a function of time of year. Engine discharges associated with water surface, water column, and sediments will be measured and fingerprinted by gas chromatography. Studies will be made to correlate the levels and fingerprints of these products to primary productivity and consumer and decomposer activity. Laboratory and field studies will be conducted establishing the kinetics of removal via microbial, adsorptive and evaporative mechanisms for a loading estimate in terms of a boating hour index.

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AGRICULTURAL SOURCES

1B2039

OUTPUT: Methods and management practices for abatement and control of pollution from agricultural sources. These sources include, among others, forestry and logging operations, agricultural and natural runoff, irrigation return flows, animal feedlot operations, and recreation facilities. Program efforts will include: (1) definition of the nature, extent, and effects of pollution from the various sources; (2) development of mathematical models and improved cultural practices to mitigate the pollution; and (3) development of criteria for promulgating specifications and guidelines for design and operation of control procedures. Where applicable, complete recycle technology will be developed.

DEVELOPMENT OF INNOVATIVE AND ECONOMICAL WASTEWATER TREATMENT
AND DISPOSAL METHODS, EQUIPMENT AND CRITERIA FOR
RECREATIONAL FACILITIES AND AREAS USED ONLY SEASONALLY

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Flora Filter for Wastewater Treatment			21APP 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR David Papier, Ohio Department of Water Resources Water Management Department Columbus, Ohio 44077			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Eugene F. Harris Edison Water Quality Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/1/71	3/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$77,329 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The overall program objective is to demonstrate the feasibility and effectiveness of a Flora Filter system for wastewater treatment in a recreational area. The Flora Filter system will eliminate the problems associated with the disposal of wastewater on soils, and provides an ideal system for seasonal treatment required in recreational areas. In this system, urea-formaldehyde foam is sprayed on soil or an impervious surface and Merion Bluegrass is hydroseeded on the foam. Wastewater is applied to the foam by overhead irrigation. The system will remove BOD, suspended solids and nutrients from the wastewater and produces a marketable crop.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Recirculating Catalytic Oxidation Waste Treatment System			21APP 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Paul D. Nance, Thiokol Chemical Corporation P. O. Box 524 Brigham City, Utah 84302			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/71	6/30/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$45,098 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

This project will develop and demonstrate a non-biological waste treatment system which eliminates the organic wastes in sewage and makes the water suitable for reuse in flushing toilets, thus obviating the necessity for a water supply for waste disposal. To demonstrate the performance of the developed system, it will be installed at the top of Freds Mountain (10,400 feet elevation), Alta, Wyoming, to treat the sanitary sewage generated by the customers and employees of a restaurant located there. The restaurant will have a seating capacity of 60 and is expected to serve as many as 500 customers per day. An estimated 1,500 gal/day of sanitary wastes will be treated. Treated wastes will have less than 50 mg/l of BOD₅, less than 50 mg/l of suspended solids, and less than 100 MPN of coliform organisms per 100 ml.

*For Grantee: Grand Targee Resort Area, Inc.
P.O. Box 117, Driggs, Idaho 83422

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RESEARCH TASK/PROJECT TITLE Demonstration of Non-Aqueous Sewage Disposal System for Recreational and Remote Areas			FY 1973 TASK NUMBER 21APP 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Floyd Matthew 4635 Wentworth Drive Rapid City, South Dakota 57701		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William J. Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/15/71	EST. COMP. DATE 3/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$75,213 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The overall project is to demonstrate the feasibility and effectiveness of using a compact, closed-loop, non-aqueous system for collecting, transporting and disposing of domestic waste at remote and recreational areas where conventional methods of disposal are undesirable because of needs to protect recreational and underground waters and in areas where water is in short supply. It will be demonstrated that water conservation is achieved since a non-aqueous flush media will be utilized. The system will be demonstrated and evaluated during both winter and summer seasons at a facility serving the recreational and tourist industry. The physical, biological, pathological, chemical, and aesthetic characteristics of the flush media will be demonstrated.

Specific technical data to be determined and evaluated includes: (1) Data on the useful life of the flush media; (2) per capita waste loading to establish future design criteria; (3) effectiveness of the incineration process; and (4) operational maintenance and reliability data to project optimum operational techniques and procedures.

For Grantee: Black Hills Conservancy Sub-District
 P.O. Box 1692, Rapid City, South Dakota 57701

MINING SOURCES

1B2040

OUTPUT: Methods and management programs for the prevention, alleviation, and abatement of water pollution caused by mineral extraction and mining activities. Program efforts will also be directed towards the development of criteria for the establishment of water quality standards. Demonstration projects will be initiated to determine the engineering feasibility and the economic vectors associated with large-scale abatement and control measures.

TREATMENT OF MINE DRAINAGE

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Lime/Limestone Treatment of Ferric Iron Acid Mine Drainage			21AFY 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER R. B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
1/70	3/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$2,000	
TASK/PROJECT DESCRIPTION AND REPORTS				

Studies were conducted to optimize the process of treating acid mine drainage, containing a relatively high concentration of ferric iron as compared to the concentration of ferrous iron, by the addition of lime and limestone. Work during FY 1973 will be the completion of the final report.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Lime/Limestone Neutralization of Acid Mine Drainage			21AFY 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alten F. Grandt Peabody Coal Co., 301 N. Memorial Drive St. Louis, Missouri 63102			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John F. Martin, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
11/6/68	5/8/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$472,400 (69)	
TASK/PROJECT DESCRIPTION AND REPORTS				

This project is for the design, construction and operation of a full-scale demonstration plant for the neutralization of acid mine drainage utilizing lime and limestone. Project objectives are to develop techniques to optimize neutralization efficiency, minimize chemical and operating costs, and to obtain information for application of this process at other locations.

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RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Trough Creek Limestone Barrier Installation and Evaluation			21AFY 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John J. Demchak Div. of Dev. Research, Dept. of Environmental Resources P. O. Box 1467, Harrisburg, Pennsylvania 17120		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John F. Martin, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/22/70	4/22/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$28,160 (70)

TASK/PROJECT DESCRIPTION AND REPORTS

The Commonwealth of Pennsylvania shall construct limestone barriers at six locations in the Trough Creek Watershed for the purpose of eliminating mine drainage pollution of Trough Creek. As a part of constructing these barriers, an investigation and evaluation of the effectiveness of the barriers will be undertaken. This will include: (1) analysis of selected samples of limestone that will be tagged and placed within the barriers; (2) chemical analysis of the stream; (3) flow gauging; and (4) evaluation of hydraulic design and recommendations for improvement.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Studies on Removal of Manganese from Mine Drainage			21AFY 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ralph Rozelle Wilkes College Wilkes Barre, Pennsylvania 18703		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/1/72	5/31/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$16,245

TASK/PROJECT DESCRIPTION AND REPORTS

A study of several methods of removing manganese from mine drainage using strong oxidizing agent including ozone and chlorine. Study will include oxidation rates, effect of pH, and interfering ions.

First phase of study has been completed.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Assemble and Shakedown Existing Neutralization Plant			21AFY 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/31/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$89,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Assemble and put into operating condition the chemical treatment plant which was moved from Norton, West Virginia, to Crown, West Virginia.

The plant will be used to neutralize acid mine drainage in order to obtain data concerning the feasibility and economics of treating mine drainage with a high concentration of ferric iron.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Construction of Mine Water Treatment Plant at Hollywood, Pennsylvania			21AFY 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchalk, Commonwealth of Pennsylvania Dept. of Environ. Resources, P. O. Box 1467 Harrisburg, Pennsylvania 17120		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald D. Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
3/68	6/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$700,000 (67)	

TASK/PROJECT DESCRIPTION AND REPORTS

This project is a demonstration of the treatment of acid mine waters by neutralization. Investigations of five basic treatment processes comprise the actual demonstration study in this 500,000 gallon per day plant. These five processes are as follows: (1) flash mixing, aeration and settling; (2) flash mix, aeration, thickening, settling; (3) thickening (with lime, sludge recycle, supernatant discharge; (4) biological oxidation tank, thickening, limestone reactor, settling; and (5) trickling filter, thickening, limestone reactor, settling.

Project is completed except for final report.

RESEARCH TASK/PROJECT TITLE Optimization of a Combination Lime/Limestone Treatment of Ferrous Iron AMD			FY 1973 TASK NUMBER 21AFY 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE 1/30/73	EST. COMP. DATE 12/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$25,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Studies will be made to optimize the process of treating acid mine drainage, containing a relatively high concentration of ferrous iron as compared to the concentration of ferric iron by the addition of a combination of lime and limestone.

RESEARCH TASK/PROJECT TITLE Evaluation of Lime-Soda Ash Treatment of Neutralized Mine Drainage			FY 1973 TASK NUMBER 21AFY 17	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchak, Commonwealth of Pennsylvania Department of Environ. Res., P.O. Box 1467 Harrisburg, Pennsylvania 17120			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Roger Wilmoth, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE 6/18/70	EST. COMP. DATE 2/28/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$78,930 (69)	

TASK/PROJECT DESCRIPTION AND REPORTS

A full scale lime-soda ash treatment process will be applied to each of four different water sources and evaluated, to determine the following: (1) chemical dosages required to yield finished water which will meet specific water use criteria; (2) operational factors associated with the process; (3) operation of the process on various feed water for sufficient time to determine the relevant operating costs and such variables as sludge production and settling rates, ease of continuous operation along with maintenance and labor required; and (4) attempt to evaluate the feasibility and economics of the lime-soda process for municipal and industrial uses on feed waters containing under 500 mg/TDS and over 500 mg/l TDS.

The operational systems provided for this experimental work would include a 7.0 MGD capacity for lime neutralization consisting of rapid mixing, slow mixing, aeration and sedimentation. This will be followed by a 3.5 MGD capacity reactor-clarifier for the soda softening process with recarbonation, for this final stage of treatment.

Plant is scheduled to go in operation February 1973.

RESEARCH TASK / PROJECT TITLE Thickening and Dewatering of Precipitates from the Lime/Limestone Treatment of Mine Water			FY 1973 TASK NUMBER 21AFY 22
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Joseph W. Leonard West Virginia University Morgantown, West Virginia 26506		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Roger C. Wilmoth, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE 2/5/70	EST. COMP. DATE 3/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$69,957 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

This project will provide the technical information necessary so that: (1) existing knowledge may be properly applied; and (2) new or conceptual knowledge may be utilized in order to densify the sludge which results from lime or limestone mine water treatment. Knowledge and procedures in the areas of both chemical and mechanical densification will be employed. Broad areas of specialization which are concerned with these techniques include: coagulation, flocculation, decantation, filtration, thickening, centrifuging and cycloning.

Final report is being prepared.

RESEARCH TASK / PROJECT TITLE Optimization of Lime and Limestone Sludge Dewatering and Compaction			FY 1973 TASK NUMBER 21AFY 26
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE 6/1/71	EST. COMP. DATE 5/30/75	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$55,000

TASK / PROJECT DESCRIPTION AND REPORTS

Studies will be made to optimize the dewatering and compaction of lime, limestone and lime/limestone sludges created by neutralization of acid mine drainage.

The use of drying beds, lagoons, filtration and spray irrigation will be investigated.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Demonstration of Purification of Acid Mine Drainage by Neutrolosis			21AFY 29
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. L. Blackshaw, Engineering Experiment Station West Virginia University Morgantown, West Virginia 26506		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/25/71	3/31/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$33,500

TASK / PROJECT DESCRIPTION AND REPORTS

This project was for the construction and shakedown of a reverse osmosis system to further study the reverse osmosis-neutralization system for complete treatment of acid mine drainage. A 60,000 gpd R.O. unit was ordered. The test facility is under construction.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Treatment of Acid Mine Drainage Using a Spiral Wound Reverse Osmosis Unit			21AFY 30
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Roger C. Wilmoth, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
2/1/73	8/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$20,000

TASK / PROJECT DESCRIPTION AND REPORTS

A spiral wound reverse osmosis unit will be used to treat acid mine drainage. Data will be obtained concerning desirable ranges of pH, ion concentration, pressure, recycle rate and flow rates. The amounts and effects of precipitates will be recorded under various operating conditions.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Optimization Studies on the Use of Reverse Osmosis on Ferrous Iron		21AFY 33	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Roger C. Wilmoth, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION
5/1/73	9/1/73		Federal Cost: \$21,000
TASK / PROJECT DESCRIPTION AND REPORTS			

Pilot Plant studies will be made using the neutrolosis process. Neutrolosis will be used in combination with reverse osmosis to produce a useable water from acid mine drainage with very small amounts of sludge created for disposal.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Electrochemical Removal of Heavy Metals from Acid Mine Drainage		21AFY 46	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchalk, Commonwealth of Pennsylvania Department of Environ. Resources, P.O. Box 1467 Harrisburg, Pennsylvania 17120		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald D. Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION
10/13/71	6/30/73		Federal Cost: \$89,457 (71)
TASK / PROJECT DESCRIPTION AND REPORTS			

Laboratory studies will be conducted to develop the design parameters for an electrochemical process for converting ferrous iron to ferric iron. A pilot plant will be constructed and operated for a three month period on an actual mine discharge.

Project is in pilot plant stage.

POLLUTION CONTROL METHODS FOR SOLID FUEL SURFACE MINING AND
OTHER SURFACE PROPERTIES OF SOLID FUEL MINING

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
State-of-the-Art - Surface Mining Pollution Control			21AFZ 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Elmore C. G. im, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
7/1/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural		Federal Cost: \$25,000

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to prepare a report on State-of-the-Art for surface mining pollution control. It will provide up-to-date procedures for maximum, solid, mineral recovery while providing the best available reclamation techniques for the surface mined areas. Emphasis will be placed on mine drainage pollution control before, during, and after mining.

Project phases consist of: (1) review of available literature concerning surface mining of solid minerals; (2) contact the various State and Federal agencies who have expertise in surface mining; (3) visitations to various states for on-site investigation of surface mining under varying conditions; and (4) recognize the future research needs to control pollution from surface mining.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Mine Spoil Potentials for Soil and Water Quality			21AFZ 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard M. Smith, Division of Plant Sciences West Virginia University Morgantown, West Virginia 26506		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Benton Wilmoth, EPA, Region III, Phil. Pa. Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Wheeling, W. Va.		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
12/71	12/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$99,903 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this study is to assure that variable earth materials in surface mine spoils and mine slags are placed and treated appropriately for prevention of water pollution and development of desirable soils and landscapes. This will be accomplished by: (1) identifying, correlating, describing and sampling soil and rock strata in regions where surface mining is in progress or planned; (2) determining chemical, physical and mineralogical properties of soil, rock, mine spoil and mine slag samples involved in water quality problems; (3) determining natural or induced weathering processes and rates for earth materials in known or controlled environments; and (4) determining interactions among spoils, amendments, plants (including microbes) and water over both short and long time intervals.

Major emphasis will be placed upon refining methods used to classify the pollution potential of overburden material representative of the Appalachian Region and to apply these methods at a few selected field sites by analyzing the overburden prior to mining, recommending appropriate reclamation procedures and determining the effectiveness of these procedures.

RESEARCH TASK/PROJECT TITLE Evaluation of Millers Run and Campbells Run Mine Drainage Pollution Abatement			FY 1973 TASK NUMBER 21AFZ 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchak, Commonwealth of Pennsylvania Department of Environ. Resources, P.O. Box 1467 Harrisburg, Pennsylvania 17120		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 11/6/70	EST. COMP. DATE 8/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$49,748 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to evaluate the effectiveness of abatement procedures for acid mine drainage which are to be applied on the Millers Run and Campbells Run areas of Western Pennsylvania. The abatement procedures to be evaluated are surface mine reclamation, stream channel sealing and mine sealing.

RESEARCH TASK/PROJECT TITLE Demonstration of Control of Acid Drainage from Coal Mine Refuse Piles and Slurry Areas			FY 1973 TASK NUMBER 21AFZ 18
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. L. Barthauer, Vice President Midwestern Div., Consolidation Coal Company Liberty, Pennsylvania 15129		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER E. E. Chaudoir, Region V, EPA, Chicago, Ill. Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Evansville, Indiana	
BEGINNING DATE 10/68	EST. COMP. DATE 3/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$490,560 (68)

TASK/PROJECT DESCRIPTION AND REPORTS

This project is to demonstrate suitable methods for reclamation of coal preparation plant refuse piles and slurry lagoons to eliminate acid drainage. Information derived from this study should provide a rational and engineering procedure for future reclamation projects.

Field work is complete. Draft of final report is under review.

CONTROL OF POLLUTION FROM UNDERGROUND SOLID FUEL MINES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Catawissa Creek Mine Drainage Pollution Abatement Project			21AGA 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchalk, Commonwealth of Pennsylvania Department of Environ. Resources, P.O. Box 1467 Harrisburg, Pennsylvania 17120			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
7/68	3/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$365,540 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

This project is designed to confirm previous estimates of mine drainage pollution abatement and to evaluate the at-source control method of inundation of a mine by plugging three existing drainage tunnels within an isolated pocket of coal. Inundation of the mine will attempt to prevent acid mine drainage formation by displacing the air with water.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Study of Use of Inert Gas to Eliminate Acid Pollution from Deep Mines			21AGA 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchalk, Commonwealth of Pennsylvania Department of Environ. Resources, P.O. Box 1467 Harrisburg, Pennsylvania 17120			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/6/68	5/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$83,784 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

An abandoned grift mine of approximately 200 acres will be sealed, and air-blowing and monitoring equipment installed. The air leak rate from the mine will be determined by correlating variable air input rates to the changes in the barometric pressures and temperatures in the mine.

The proposed test mine was found to be unsuitable for these tests.

Final report is being prepared.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Laboratory Study of Self-Sealing Limestone Plugs for Mine Openings			21AGA 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR J. C. Troy, Cyrus Wm. Rice, Division NUS Corporation, 1910 Cochran Road Pittsburgh, Pennsylvania 15220		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James Shackelford, Off. of Air & Water Pro. Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Washington, D.C. 20460	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/30/71	2/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$162,976 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

Laboratory studies of self-sealing limestone plugs for mine openings were conducted to determine the optimum limestone material for such a treatment and sealant technique. A pilot plant operation utilizing synthetic solutions representative of anticipated acid mine waters, aggregate additives to improve plug performance, and several basic types of limestone which were varied in terms of size of gradation and placement density were constructed and tests made.

Final report is under review.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
High Expansion Foam as a Method of Inerting Abandoned Coal Mine Areas			21AGA 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ralph H. Hiltz, Mine Safety Appliance Company MSA Research Corporation Evans City, Pennsylvania 16033		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John F. Martin, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
1/29/72	12/29/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$56,870 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The program to evaluate use of the high expansion foams as a sealing and inerting mechanism within worked out areas would be conducted in four phases as follows: (1) procure and develop suitable mine area; (2) evaluate the effectiveness of a new polyurethane formulation for sealing; (3) determine further benefit from completely filling the remaining area with polyvinyl alcohol foam; and (4) observe and analyze water issuing from the area for one hydrological cycle.

NEW MINING METHODS

RESEARCH TASK/PROJECT TITLE A Demonstration of a New Mining Technique to Prevent the Formation of Mine Acid in an Active Mine			FY 1973 TASK NUMBER 21AGB 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Roy C. Taliaferro, Island Creek Coal Company Island Creek Division Holden, West Virginia 25625			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Donald O'Bryan, Off. of Res. & Dev. Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Washington, D.C. 20460	
BEGINNING DATE 6/30/71	EST. COMP. DATE 3/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$582,239 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

This project is Phase II of a program to demonstrate that mining coal in an oxygen-free atmosphere will prevent the formation and subsequent discharge of mine drainage pollution into streams and other water courses. The objective of Phase II is to test the important systems, especially the life support system, in an active ventilated mine and prepare a detailed design of the demonstration mine including estimated costs of construction and operation.

The Phase I project was a system engineering evaluation that determined the feasibility of mining in an inert gas atmosphere using "space age technology."

Phase II is in its final stages.

RESEARCH TASK/PROJECT TITLE Feasibility Study of a New Surface Mining Method			FY 1973 TASK NUMBER 21AGB 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR H. F. Moorman, Potomac Engineering & Surveying P. O. Box 306 Petersburg, West Virginia			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John Mulhern, Off. of Res. & Dev. Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Washington, D.C. 20460	
BEGINNING DATE 10/18/72	EST. COMP. DATE 2/18/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$88,021 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

A feasibility study will be made to determine the technological and economical feasibility of using long wall mining techniques on surface mines.

SMALL DRAINAGE BASIN WATER POLLUTION CONTROL DEMONSTRATION

RESEARCH TASK/PROJECT TITLE Demonstration of Technique of Water Infiltration Control to Achieve Mine Water Pollution Control			FY 1973 TASK NUMBER 21AGC 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Edgar Henry, West Virginia Dept. of Natural Resources 1800 Washington St., E. Charleston, West Virginia 25305			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.	
BEGINNING DATE 7/1/71	EST. COMP. DATE 12/31/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$672,047 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate on a full scale, the technique of water infiltration control as a means of achieving mine water pollution control in the Dents Run Watershed. Reclamation of the surface mines will eliminate their diversion of runoff into the underground mine water system. The feasibility study is completed and construction has begun.

RESEARCH TASK/PROJECT TITLE Tioga River Mine Drainage Pollution Abatement Project			FY 1973 TASK NUMBER 21AGC 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Demchak, Commonwealth of Pennsylvania Department of Environ. Resources, P.O. Box 1467 Harrisburg, Pennsylvania 17120			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Eugene F. Harris, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/71	EST. COMP. DATE 8/31/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$450,000 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the effectiveness of restoration of unreclaimed strip mines as a technique for the abatement and reduction of acid mine drainage. Elements of this demonstration include the burial of coal refuse and other acid forming materials within strip pits as a part of the restoration operation, the reconstruction of stream channels, the restoration and/or grouting of subsidence areas and the reestablishment of a vegetative cover using agricultural lime-stone and digested sewage sludges as soil conditioners.

The project work will include the establishment of a gauging, sampling and analytical program to be carried out during the life of the project. During the early gauging, sampling and analytical program, feasibility will be established and then construction plans and specifications will be prepared and construction contracts let in a logical sequence. Monitoring of the mine drainage discharges and receiving streams will continue during and after construction so that the effectiveness of the techniques can be documented. Accurate cost records will be maintained of construction costs.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Lake Hope Mine Drainage Demonstration Project			21AGC 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR S. L. Frost, State of Ohio Department of Natural Resources Columbus, Ohio 43215			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Eugene F. Harris, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/25/71	10/1/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$808,000 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The Lake Hope project will demonstrate the control and elimination of mine drainage pollution by refuse pile disposal and/or covering and underground mine sealing. Acid producing coal refuse will be removed and buried in suitably prepared sites. These sites will be finished, graded, and seeded. Non-acid producing coal mine refuse piles will be reshaped to existing contours, covered and reclaimed by appropriate seeding and tree planting for erosion control and aesthetic enhancement. The mine sealing demonstration program will be undertaken in two phases. The first phase will seal those mine openings which have been determined the most significant acid discharges, and those openings immediately adjacent to or suspected of having connection with the high acid concentration discharge openings. The second phase will seal selected remaining mine openings as determined by the continuous water quality monitoring data obtained. Continuous water quality monitoring systems will obtain data to be evaluated over the life of the project and after all construction has been completed. Feasibility study is completed.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Reuse of Treated Active Surface Mine Drainage for Revegetation Augmentation			21AGC 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert E. Nickel, Commonwealth of Kentucky Department of Natural Resources Frankfort, Kentucky 40601			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald D. Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
5/4/71	12/31/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$322,068 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to determine on a full scale, the use of a mobile neutralization plant to treat acid mine drainage from a surface mine and utilize the treated water to irrigate new vegetative cover on regraded spoil banks in order to achieve higher vegetative survival and to eliminate pollution. Demonstration will be made in Western Kentucky.

Feasibility study is completed.

RESEARCH TASK/PROJECT TITLE Demonstration of Debris Basins for Control of Surface Mine Sedimentation in Steep Slope Terrain			FY 1973 TASK NUMBER 21AGC 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert E. Nickel, Commonwealth of Kentucky Department of Natural Resources Frankfort, Kentucky 40601		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John F. Martin, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 6/19/72	EST. COMP. DATE 5/31/76	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$229,058 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of the project is to demonstrate the effectiveness of debris basins to control sediment discharges from surface mining operations in steep slope terrain. These basins will be constructed in accordance with present rules, regulations and legislative requirements under actual working methods as currently practiced in the eastern Kentucky coal fields.

The project will consist of five phases. Phase I - will be a detailed feasibility study; Phase II - will be for engineering (surveying, mapping and design review); Phase III - will be the actual mining operations; Phase IV - will be for monitoring; and Phase V - will be for the preparation of the Final Report. The final report will include all pertinent project data and the evaluation and effectiveness of the demonstration program.

RESEARCH TASK/PROJECT TITLE Elk Creek Watershed Demonstration Project			FY 1973 TASK NUMBER 21AGC 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Edgar Henry, West Virginia Department of Natural Res. 1201 Greenbrier Street Charleston, West Virginia 25311		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Scott, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, EPA, Norton, West Va.		
BEGINNING DATE 6/15/72	EST. COMP. DATE 6/14/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$448,700 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of the project is to demonstrate the effectiveness of three at-source (impermeable slurry trench, deep mine roof collapse and regrading alkaline spoil material) mine drainage pollution control methods at abandoned surface and deep mine sites. The project will consist of four phases: Phase I - detailed feasibility study; Phase II - detailed plans and specifications; Phase III - construction of the abatement facilities; and Phase IV - Monitoring and final report.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Deer Park Daylighting Project			21AGC 07(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John R. Matis, Department of Natural Resources Water Res. Admn., Tawes State Office Building Annapolis, Maryland 21401		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Elmore C. Grim, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/15/72	9/11/75	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$550,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to demonstrate the effectiveness of daylighting as a procedure for acid mine drainage pollution abatement while providing adequate land reclamation to the immediate and adjacent surface land area. As the secondary objective, the project will demonstrate the effectiveness of erosion and sediment control in preventing stream pollution and siltation during and following active surface mining.

The project is divided into five phases: Phase I - the indepth feasibility study; Phase II - the engineering design; Phase III - the construction (actual mining operation); Phase IV - monitoring for one hydrologic cycle; and Phase V - the Final Report. The Final Report shall include all pertinent project data and the evaluation and effectiveness of the demonstration project.

MINING SOURCES (ORES)

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
A Study of the Carbonate Bonding of Taconite Tailings		21AGF 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR E. A. Pelczarski, Applied Technology Corporation 135 Delta Drive Pittsburgh, Pennsylvania 15238		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald D. Hill, Mine Drainage Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
4/72	12/72	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$18,914 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

A bench scale experimental effort primarily to determine the range of operating parameters that will result in strong carbonate bonded taconite tailings that are impermeable to air and water as is concrete. The taconite tailings thus studied will be mixed with various amounts of lime hydrate to determine the effects of the variables on strength properties such as compression and flexure. Selected briquettes will be subject to compression and flexure loading tests to determine their strength as a function of time, lime content and water content.

OIL AND HAZARDOUS MATERIAL SPILLS 1B2041

OUTPUT: Technology for: (1) the prevention of oil and hazardous material spills; and (2) the detection, control, and restoration of the water environment following accidental spills. Emphasis will be directed toward spill prevention and control methods at industrial complexes, storage terminals, and major transportation sources. Methods will be developed for remote and congested areas, warm and cold climates, and fresh and marine waters. Rapid detection and countermeasure techniques and methods for the ultimate disposal or recycling of oil and hazardous materials removed from spill sites will be demonstrated.

OIL SPILL SURVEILLANCE SYSTEM

RESEARCH TASK/PROJECT TITLE		FY1973 TASK NUMBER	
Oil Spill Surveillance System		21ANO 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR H. G. Eldering, Baird-Atomic, Inc. 125 Middlesex Turnpike Bedford, Massachusetts 01730		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Kurt Jakobson, OR&D, Washington, D.C. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/30/71	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$185,298 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The contractor shall furnish the necessary personnel, facilities and equipment to complete a prototype Florescence Oil Spill Surveillance System. The technical approach shall include the following five tasks: (1) determine detailed florescence excitation/emission signatures and emission efficiency data on model oils; (2) design and construct a prototype florescence oil spill surveillance instrument employing a pulsed xenon source; (3) design and evaluate an alternate laser source; (4) test the oil surveillance system at the Baird-Atomic plant; and (5) field test the system in a work demonstration effort at a site to be recommended by Baird-Atomic and approved by the EPA project officer.

NATIONAL CONFERENCE ON THE PREVENTION AND CONTROL OF SPILLS OF HAZARDOUS MATERIALS

RESEARCH TASK / PROJECT TITLE Joint EPA-API-Coast Guard Conference on Prevention and Control of Oil Spills			FY 1973 TASK NUMBER 21ANR 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Jack Gould, Secretary, American Petroleum Institute 1801 K. Street, N.W. Washington, D.C. 20006		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Kurt Jakobson, OR&D, Washington, D.C. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/1/72	EST. COMP. DATE 8/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$10,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to sponsor a joint conference with the American Petroleum Institute and the U.S. Coast Guard on the prevention and control of oil spills. At this conference, the current state of the research in the field of oil pollution will be presented. This research includes oil spill prevention, oil pickup, oil disposal, and the effects of oil spills. This three-day conference will be held in Washington, D.C. A compilation of the papers presented at this conference will be published.

PHYSICAL REMOVAL OF SETTLED HAZARDOUS MATERIALS IN WATERCOURSES

RESEARCH TASK/PROJECT TITLE Demonstration of Methods to Physically Remove Spilled Hazardous Materials from Bottoms of Watercourses (A)			FY 1973 TASK NUMBER 21ANS 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert Sanders, Ind. Bio-Test Laboratories, Inc. 1810 Frontage Road Northbrook, Illinois 60062		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph P. Laformara Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 7/20/72	EST. COMP. DATE 3/31/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$52,679 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

This is one of two projects (the other, Project No. 68-03-0182 (21ANS-02a), is being carried out by Rex Chainbelt, Inc.) to demonstrate and evaluate methods of removing spilled, insoluble, heavier-than-water, hazardous materials from the bottoms of watercourses. The site for this demonstration and evaluation is a designated 500-ft. section of a creosote-contaminated stream in Milwaukee, Wisconsin, namely the Little Menomonee River. In this demonstration it is essential that the general contour of the stream, as well as the banks, shorelines and vegetation, not be disturbed. This requirement eliminates the more conventional dredging methods. In a continuous operation, creosote, river mud, and detritus will be fluidized with a hand-held vacuum head and pumped to a large sedimentation tank to which flocculants are added. The settled-out creosote and mud will be periodically drawn off and hauled to a sanitary landfill disposal site. The water, which contains solubilized and dispersed creosote and mud fines, will be passed through a high rate, filtration settling column and then pumped through the "EPA 'Dynactor' and Magnetic Separator" (developed by the contractor under Contract #68-01-0123, (21ANX 02). Polishing, if required, will be done with a second high rate, lamellar flow, filtration settling column. The treated water will be tested for creosote/mud content and either returned to the stream or cycled for retreatment. During the demonstration, the water in the Little Menomonee River will be tested above and below the operation site to assure that water quality is not degraded. The superior creosote-removal method (this one or the method being evaluated under Project 68-03-0182) will then be applied to the cleanup of the entire contaminated length (2-1/2 miles) of the Little Menomonee.

RESEARCH TASK/PROJECT TITLE Demonstration of Methods to Physically Remove Spilled Hazardous Materials from Bottoms of Watercourses (B)			FY 1973 TASK NUMBER 21ANS 02a
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert Agnew, Ecology Division Rex Chainbelt, Inc., P.O. Box 2022 Milwaukee, Wisconsin		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph Laformara Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 7/31/72	EST. COMP. DATE 3/31/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$83,333 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

This is one of two projects (the other, Project No. 68-03-0182 (21ANS 02a) is being carried out by Rex Chainbelt, Inc.) to demonstrate and evaluate methods of removing spilled, insoluble, heavier-than-water hazardous materials from the bottoms of watercourses. The site for this demonstration and evaluation is a designated 500-ft. section of a creosote-contaminated stream in Milwaukee, Wisconsin, namely, the Little Menomonee River. In this demonstration it is essential that the general contour of the stream, as well as the banks, shoreline and vegetation, not be disturbed. This requirement eliminates the more conventional dredging methods. Creosote, river mud, and detritus--as Ca. 5% slurry--will be removed continuously from the river bed with a specially designed vacuum head. The head will be manipulated from a flotation tank-supported frame that permits vertical, lateral, and horizontal movement of the suction head. Repositioning of the frame itself will be achieved by adjustment of cables secured to the river bank. The slurry will be fractionated into solids and water with the EPA "Mobile Beach Cleaner" (developed by another EPA Contractor). The solids will be disposed of at an approved sanitary landfill. The liquid will be passed through a large sedimentation tank to which flocculants will be added and then processed in the EPA "Modular Spills Treatment Unit", developed by Rex Chainbelt under EPA Contract #68-01-0099 (21ANX 03). Effluent from the treatment process will be tested for creosote/mud content and then either returned to the river or reprocessed, as required. During the demonstration, the water in the Little Menomonee River will be tested above and below the operation site to assure that water quality is not degraded. The superior creosote-removal method (this one or the method being evaluated under Project 68-03-0181) will then be applied to the cleanup of the entire contaminated length (2-1/2 miles) of the Little Menomonee.

RESEARCH TASK / PROJECT TITLE Documentation of Methods for the Removal of Settled Hazardous Materials in Watercourses		FY 1973 TASK NUMBER 21ANS 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Edward H. Bryan, Citizens for Menomonee River Restoration, Inc., 1545 South 108th Street Milwaukee, Wisconsin 53214		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph Laforana Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 10/2/72	EST. COMP. DATE 10/2/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$17,000

TASK / PROJECT DESCRIPTION AND REPORTS

A 13-1/2 minute sound, color motion picture documentary film will be produced to show: (1) original state of the creosote-contaminated Little Menomonee River, including footage of volunteers attempting clean-up; (2) operations by two EPA contractors (Rex Chainbelt, Inc., and Industrial Bio-Test Industries, Inc.) in applying EPA-sponsored removal systems to separate 500-foot sections of the River; (3) clean-up operations on the entire 2-1/2 mile contaminated length of the River by an EPA-selected "best" approach for clean-up; and (4) views of the River some time after the full-scale clean-up to indicate the effectiveness of the operation and the accompanying restoration of the River to a creosote-free and environmentally "clean water" condition.

COLLECTION OF CONTAINED SPILLED HAZARDOUS MATERIALS

RESEARCH TASK/PROJECT TITLE Control of Hazardous Chemical Spills by Physical Barriers			FY 1973 TASK NUMBER 21ANV 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ralph Hiltz MSA Research Corporation Evans City, Pennsylvania 16033		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ira Wilder Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/29/71	EST. COMP. DATE 2/28/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$160,688 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to develop and demonstrate methods to confine spills of hazardous materials on land by use of polyurethane compounds, and low and high expansion foamed inorganics. Selected high priority hazardous materials, including ammonia, chlorine, acrylonitrile, acetone cyanhydrin, methyl alcohol, phenol, lindane, and an organic mercury solution, will be used to select an appropriate compatible foam, structurally stable for creating foam dikes. The methods are to result in a portable, high capacity foaming device which can be deployed immediately following a spill, handled, for example, as a back-pack and installed and carried on a transporting vehicle.

RESEARCH TASK/PROJECT TITLE A Physical Barrier to Contain Spilled Hazardous Materials in Watercourses			FY 1973 TASK NUMBER 21ANV 02a
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Frank A. March, Ocean Systems, Inc. 11440 Isaac Newton Industrial Square, North Reston, Virginia 22070		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Paul Heitzenrater, OR&D, Washington, D.C. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/29/71	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$148,518 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

Phase I. The objective of this project is to develop and test a physical barrier that can be used to contain spilled hazardous materials in watercourses to prevent dispersion to surrounding waters. Incorporated in the barrier is an air-inflated flotation collar which supports the top of the barrier, and a water-inflated seal which seals the bottom of the barrier to the bottom of the watercourse. Components necessary for deployment will be evaluated to optimize functional and operational procedures under actual field conditions in both a lake and flowing stream. The ability of the barrier to withstand currents up to three knots in a tidal situation will be determined.

Phase II. Based on evaluation in flowing stream tests, the barrier will be redesigned and refabricated. The improved barrier will be maintained in a ready-to-use condition until it can be deployed and evaluated in an actual spill situation under a stand-by contract to be issued by the Division of Oil and Hazardous Materials, EPA. The final report will not be issued until the on-site spill evaluation test of Phase II has been completed.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Emergency Collection System for Spilled Hazardous Materials			21ANV 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ralph Hiltz, Senior Scientist MSA Research Corporation Evans City, Pennsylvania 16033		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John E. Brugger Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
11/10/72	11/10/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$67,500

TASK/PROJECT DESCRIPTION AND REPORTS

A field-operable, liquid pumping system for collecting spilled hazardous materials in a plastic bag will be developed and tested. The system will weigh less than 1000 lbs., be pallet mounted, and occupy a shipping volume no greater than 4' x 4' x 2'. The major components are: (1) a high efficiency, explosion-proof pumping system; (2) a rechargeable battery pack; (3) two 7000 gallon plastic collection bags; (4) hoses, piping, and valves; and (5) necessary electrical switching components. The system will operate for at least 2 hours at a maximum head of 30 feet. The pump will operate at a rate of at least 100 gpm at no head with liquids of viscosity up to 100 cps. The bags will be self-deployable, non-rolling on steep hillsides, and chemically resistant to most hazardous liquids. The system will be designed, fabricated, and field tested with subsequent modification, if necessary, to evolve a working prototype.

HAZARDOUS MATERIAL SPILL ENVIRONMENTAL EVALUATION

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Disposal Techniques for Spilled and Unused Pesticides			21ANW 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR E. W. Lawless, Chemist, Process Chem. Section Midwest Res. Institute, 425 Volker Boulevard Kansas City, Missouri 64110			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John E. Brugger Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/29/71	6/29/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$60,800 (71)	
TASK/PROJECT DESCRIPTION AND REPORTS				

The purpose of this project is to develop and compile information describing safe and non-polluting methods for treating spilled and unused portions of pesticides or other agricultural chemicals in terms understandable by, and with equipment available to, informed laymen, county agents and public health officials. Information to be gathered and/or developed includes the toxicity and hazards of the materials, detoxification by conversion to innocuous products, treating spills in general and on a layman's property, and proper decontamination of pesticide containers and equipment. The effort will result in the preparation of a manual which could be furnished to appropriate officials for distribution of information on specific pesticides.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Land Spill Decontamination Technique			21ANW 03a	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Michael Smith Hancock Co. Port & Harbor Comm., P.O. Box 69 Bay St. Louis, Mississippi 39520			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Peter B. Lederman Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/72	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$68,500 (72)	
TASK/PROJECT DESCRIPTION AND REPORTS				

The objectives of this project are: (1) conduct a short-term research program for decontamination of spills of two hazardous materials, phenol and chlordane, at a large captive site (Mississippi Test Facility (MTF), Hancock County, Mississippi) to show the feasibility, practicality and suitability of the site as a testing facility for evaluating spill prevention, control, detoxification, disposal and restoration devices and procedures; and (2) collect and critically evaluate information and data from MTF with respect to existing facilities, potential for modification, if necessary, and general usefulness for demonstrations of prevention, control, containment, detoxification, and ultimate disposal techniques for spills of hazardous materials under full-scale conditions and in a captive area of characterized ecology, climate, geography, and hydrology.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Rapid Detection of Toxic Materials in Water			21ANW 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Louis H. Goodson, Senior Advisor for Biology Midwest Research Institute, 425 Volker Boulevard Kansas City, Missouri 64110		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Thomas Hoover, SEWL, Athens, Georgia Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
2/24/71	2/28/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$84,180 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The project incorporates the design, development, fabrication, demonstration and evaluation of an automatic water monitoring device which will provide an immediate warning signal in response to the presence of organophosphates in watercourses. Organophosphates are inhibitors of the enzyme cholinesterase which will be used as a sensor to monitor the water being sampled. Water suspected of containing organophosphates and a substrate will be passed over the enzyme in an electrochemical cell. In the absence of the organophosphates the substrate will hydrolyze and produce a low potential. When the toxic material is present the substrate will not be hydrolyzed and a high potential will activate an alarm system.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Field Detection and Damage Assessment Handbook			21ANW 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR D. M. MacArthur, Enviro Control, Inc. 1250 Connecticut Avenue, N.W. Washington, D.C. 20036		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER C. Hugh Thompson, Office of Water Programs Washington, D.C., Edison Water Q. Res. Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/21/71	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$56,297 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

This project is designed to produce a handbook of procedures and techniques which are technically and legally defensible for assessing damages to the aquatic environment resulting from discharges of oil and hazardous materials. The handbook will serve as a model for developing State response and contingency planning programs. Standardized observations, testing and reporting will result from State and local programs adopting similar damage assessment techniques.

DEVELOPMENT OF PHYSICAL-CHEMICAL TREATMENT SYSTEM FOR HAZARDOUS MATERIAL SPILLS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Devices to Treat Spilled Hazardous Materials			21ANX 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert G. Sanders, Industrial Bio Test Labs., Inc. 1810 Frontage Road Northbrook, Illinois 60062			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ira Wilder Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/29/71	4/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$138,916 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to develop a continuous flow through thin film aerator to which chemicals can be added to neutralize, oxidize, precipitate or adsorb spilled hazardous materials. A separation device to remove precipitates, carbon slurries, gasses, and other solids from the effluent of the aerator will also be investigated. High priority hazardous materials will be evaluated to determine the effectiveness of these devices.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Modular Transportable Prototype System for Treating Spilled Hazardous Materials			21ANX 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Donald G. Mason, Manager, Process Products Rex Chainbelt, Inc., P.O. Box 2022 Milwaukee, Wisconsin 53201			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph P. Lafornera Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/29/71	4/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$217,341 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to develop and fabricate a modular transportable prototype system for removing and treating spilled hazardous materials in aqueous solutions. Equipment necessary to treat most of the high priority hazardous materials will be mounted as modular units on a truck which can be driven to a spill site where treatment can be instituted immediately. Treatment will include neutralization, flocculation, precipitation, filtration, and carbon adsorption.

DEMONSTRATION OF INSTREAM TREATMENT OF HAZARDOUS MATERIAL SPILLS WITH MASS TRANSFER MEDIA

RESEARCH TASK/PROJECT TITLE Development of Mass Transfer Media for Treatment of Hazardous Material Spills			FY 1973 TASK NUMBER 21ANY 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR A. J. Shuckrow, Research Associate, Pacific NW Labs Battelle Memorial Institute, P.O. Box 999 Richland, Washington 99352			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ira Wilder Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/29/71	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$112,690 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The goal of this project is to select, test, demonstrate, and evaluate the production, subsurface application and surface collection of floatable mass transfer media for in situ treatment of spills in watercourses. Ion exchange resins and physical sorption media will be utilized to treat spills of toxic bases, acids, and organic compounds. Media will be selected that can be made floatable with a controlled rate of rise to insure optimum contact time with the contaminated watercourse. Methods will be developed to effectively deposit the media at the bottom of the watercourse under spill conditions and subsequently collect the spent media on the water surface.

RESEARCH TASK/PROJECT TITLE Development of Methods to Treat, Control, and Monitor Spills of Selected Hazardous Materials			FY 1973 TASK NUMBER 21ANY 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Roland Pilie Calspan Corporation Buffalo, New York 14221			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph P. Lafornera Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/29/71	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$494,424 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

This is a comprehensive project to develop new and effective methods to prevent selected spilled hazardous materials from reaching watercourses and to treat, control and monitor the materials in the watercourses. Materials to be investigated include anhydrous ammonia, phenol, chlorine, acrylonitrile, acetone cyanhydrin, methyl alcohol and heavy metals. The development of appropriate countermeasures will include consideration of use of neutralization, precipitation, and adsorption agents; methods for introducing treatment materials; methods to detect and monitor spilled materials; development of appropriate flotation, containment and skimming methods; bioassay determination of effects of countermeasures on the aquatic environment; and an evaluation of the logistics involved, including cost factors, safety, delivery systems, availability and storage requirements.

DEVELOPMENT OF OPERATIONAL SYSTEM FOR PLUGGING LEAKS FROM RUPTURED CONTAINERS

RESEARCH TASK / PROJECT TITLE Foamed Plastic Barriers for Stopping Spills of Hazardous Materials from Leaking Containers		FY 1973 TASK NUMBER 21ANZ 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Rex Mitchell, North American Rockwell Corporation Rocketdyne Division, 6633 Canoga Avenue Canoga Park, California 91304		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ira Wilder Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/29/71	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$99,072 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to demonstrate the feasibility of a system based on the use of foam plastic barriers to plug leaks of hazardous materials from ruptured containers on land and under water. Various types of currently available plastic foams will be tested and evaluated in the presence of high priority hazardous materials. The evaluation will include compatibility of the plugging material with hazardous substances and water resistance, bond strength, barrier effectiveness and setting time of the material under simulated spill conditions.

METHODS TO PREVENT SPILLS OF HAZARDOUS MATERIALS AT PRODUCTION
SITES, TERMINALS AND STORAGE FACILITIES

RESEARCH TASK / PROJECT TITLE Control of Toxic and Hazardous Material Spills in Municipalities		FY 1973 TASK NUMBER 21AOA 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR George A. Brinsko, Plant Supt., Allegheny County Sanitary Authority, 3300 Preble Avenue Pittsburgh, Pennsylvania 15233		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John E. Brugger Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/30/72	EST. COMP. DATE 6/30/74	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$310,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to develop a comprehensive program to identify, monitor, manage and control toxic and hazardous material spills in a municipal waste collection-treatment system serving a large metropolitan area. Included in the project are: (1) identification of character and quantity of actual and potential sources and location of toxic and hazardous materials entering the collection system to evaluate and plan for treatment strategies; (2) design and installation of a monitoring and surveillance system to verify identification of materials and provide an early warning of spilled toxic materials; (3) utilization of existing pilot plant to establish modifications to operating techniques to adequately treat toxic materials and protect the biological treatment process; and (4) development of an emergency response contingency plan for controlling hazardous material spills and model ordinances for control of discharges based on treatability studies.

RESEARCH TASK / PROJECT TITLE Pollution of Watercourses by Sudden Discharge or Spillage of Thallium and Related Metallic Compounds from Ore Refining Operations & Chemical Storage		FY 1973 TASK NUMBER 21AOA 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Thomas Magorian, Principal Geophysicist Calspan Corporation Buffalo, New York 14221		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John E. Brugger Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/21/72	EST. COMP. DATE 5/21/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$130,504 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to investigate and document the threat to the water environment due to spillage or sudden discharge of compounds of thallium and certain other related metals, such as cadmium, lead, indium, arsenic, and selenium, that are present in the residues and wastes from a variety of ore refining and chemical operations. This study will determine the magnitude of the threat to water quality posed by discharges and spills during storage and/or disposal of thallium and other wastes in holding tanks, lagoons, cinder banks, landfills, and slag deposits. A program of sampling and analysis will be conducted on the water, sediment, and biota--with special emphasis on the food chain--in watercourses near selected industries.

CHEMICAL IDENTIFICATION OF OIL SPILLS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Quantitative Analysis of Oil by Infrared Spectrophotometry			21AOE 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Michael Gruenfeld Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/1/71	3/30/73	☐ Contract ☒ Intramural ☐ Grant	Federal Cost: \$9,000	

TASK / PROJECT DESCRIPTION AND REPORTS

An in-depth assessment of infrared spectrophotometry as an analytical technique for the accurate quantitation of oil is performed. Different extraction solvents and path length cells are compared, and the Beer's Law behavior of some representative oils is established. The lower detection limits of the representative oils by this technique are also determined.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Extraction of Oil from Sediment for Quantitation Spectroscopic Analysis			21AOE 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Michael Gruenfeld Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
1/2/73	6/30/74	☐ Contract ☒ Intramural ☐ Grant	Federal Cost: \$9,000	

TASK / PROJECT DESCRIPTION AND REPORTS

A method is sought for the complete rapid extraction of small quantities of oils from sediments. Quantitative determination of extracted oil is to be achieved with a spectroscopic instrumental technique such as an infrared, ultraviolet, or fluorescence spectrophotometry. A rapid clean-up procedure is also sought for separating sediment components that interfere with the analysis.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Passive Tagging of Oils by Fluorescence Spectrophotometry			21AOE 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Michael Gruenfeld Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
8/1/72	9/30/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$15,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The initial effort is to determine whether fluorescence spectrophotometry is usable for passive tagging oils; i.e., does this technique measure oil parameters that maintain their integrity in the presence of weathering. An optimum, rapid, method will be devised if the technique proves successful. A thorough literature search, and an evaluation of similar EPA research efforts are being performed as part of this project.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Passive Tagging of Water Dispersed Oils			21AOE 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Michael Gruenfeld Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
5/1/72	10/1/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$5,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Spectroscopic and chromatographic techniques will be developed for passive tagging trace levels of water dispersed oils (0.1 - 10 ppm). Multi-instrumental techniques that have already been developed for oils occurring as slicks and shoreline residues will be optimized and evaluated for trace analysis applications.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Oil Contamination Meter			21AOE 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR M. Pragger, Nucor Corporation, Nuclear Division 2 Richmond Drive Denville, New Jersey 07834			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Leo T. McCarthy, Jr. Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/4/72	12/4/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$87,000	

TASK / PROJECT DESCRIPTION AND REPORTS

This project involves the development and demonstration of an oil contamination meter which continuously measures and records on a real time basis, the concentration of oil in treated water discharged from either marine, brackish, or fresh water contaminated by oil wastes. Based on flame emission spectroscopy, the range of quantitation is from 5 ppm to 500 ppm oil concentration in water, with a sensitivity of plus/minus 0.5 ppm in the low range and 10% of absolute concentration in the high range. Fully automatic features incorporated are: automatic ranging, self calibrating, self zeroing, self purging, self cleaning, etc. Testing to determine the effectiveness of the meter will be conducted in the laboratory and at a typical test site. A report describing the equipment design (engineering drawings, etc.) operating, assembling and maintenance procedures will be delivered upon completion of this report.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
The Feasibility of Identifying Mystery Oil Spills			21AOE 50	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Gardner S. Hunt, Dept. of Environmental Protection State of Maine Augusta, Maine			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER J. Stephen Dorrlor Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/72	5/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$39,306 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

This project will determine the feasibility of identifying oil spilled in coastal and inland waters, in conjunction with the State of Maine's Oil Conveyance law, by chemically and physically matching spilled oil to reference oil samples using readily available laboratory techniques. Oil samples will be taken from ships as required by this state law. Each sample will be divided into three parts: one for storage as a reference sample; one for field weathering; and one for weathering under laboratory conditions. The reference samples, as per the Oil Conveyance Law, will be stored for a 15-day period at a cool temperature, in a dark room, under custody of project personnel. The sample for field weathering will be spilled under controlled conditions in the waters of Casco Bay, Maine. Weathering will take place for periods up to two weeks. The laboratory weathered third sample will provide a backup for the "field" sample. This simulated weathering will take place in 500 gallon, continuously flushed, salt water tanks located within the Trigon Laboratory in South Portland, Maine. In addition to providing backup spill samples, these laboratory tests will also develop some important information on physical and chemical changes due to exposures of the oil to the environment.

OIL CONTAMINATED WATER RECYCLING SYSTEMS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Oil Contaminated Water Recycling System			21AOF 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Jerome L. Overfield, Pollution Abatement Research P. O. Box 38674 Dallas, Texas 75238			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Frank J. Freestone Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
1/3/73	12/1/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$89,874	

TASK / PROJECT DESCRIPTION AND REPORTS

The contractor will design, fabricate and demonstrate a pilot scale, 50 gpm oil-water-solids separation system for treatment of wastewater originating from an offshore oil production platform. The system shall use a chemically assisted backwashable coalescer and a chemically assisted backwash solids treater for treating wastewater containing free oil, finely dispersed oil, chemically stabilized emulsions and oil-wet solids. The objective is to obtain water effluent with less than 10 ppm oil content. The project will be divided into two phases, laboratory bench testing and pilot scale design, fabrication and testing.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Oil Contaminated Water Recycling System			21AOF 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ben Holt, President The Ben Holt Company, 201 South Lake Avenue Pasadena, California 91101			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Frank J. Freestone Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/20/72	10/20/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$93,146	

TASK / PROJECT DESCRIPTION AND REPORTS

The contractor will develop and demonstrate a conceptual system for the recycling of oil contaminated water. The system will be specifically developed to remove chemically stabilized and dissolved oils from wastewaters, and will involve the adsorption of the oil onto selected solids and recycling of the solids through a solvent cleaning stage. The project is divided into two phases, laboratory bench scale testing and pilot scale (50 gpm) testing.

OHMSETT SUPPORT (TEST BASIN)

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Construction Supervision of the OHMSETT			21A0G 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR F. Zelman, Engineers, Inc. 50 Park Place Newark, New Jersey 07101		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER David A. Mattie (EPA, Washington, D.C.) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/27/72	10/15/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$99,464 (72)	
TASK / PROJECT DESCRIPTION AND REPORTS				

The services of this contract shall be for on-site construction and supervision and inspection of the oil and hazardous materials systems control basin at Leonardo, New Jersey.

OIL SPILL CONTAMINANT DEVICES

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Mechanical Control of Oil Spills Utilizing a Streamlined Boom		21A0H 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR David Wooten, Ultrasystems, Inc. 500 Newport Center Drive, Suite 800 Newport Beach, California 92660		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER J. Stephen Dorrler Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
3/20/72	3/20/74	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$47,460 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

Development of a streamlined oil containment and collection boom including the following technical approach: (1) theoretical studies conducted to determine the hydrodynamic properties of a streamlined oil containment and collection boom; (2) measurements conducted of the hydrodynamic forces and flow pattern around a laboratory size boom and the results compared with the theoretical studies; (3) measurements and observations of an unconstrained boom, designed on the basis of data obtained in item 2, (Tests performed in the Lockheed Ocean Laboratory Towing Basin with and without waves and under steady and unsteady flow conditions); (4) use of control surface to provide positive buoyancy control and maintain proper boom orientation determined experimentally; (5) experimentally establish optimal boom thickness and chord length as a function of wave height, length and flow; (6) recommend a prototype design based on the parameters and data obtained from the laboratory tests and measurements; and (7) furnish Project Officer with still and photographic documentation of significant design and test events.

WASTE OIL RECYCLING

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Oil Recovery Program			21AOI 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Wilfred H. Shields, Chief, Solid Wastes Services Maryland Environmental Ser., State Office Building Annapolis, Maryland 21401			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Peter B. Lederman Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/1/72	10/31/72	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$141,800 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

The following tasks will be accomplished during this project: (1) perform a state-of-the-art review and analysis of existing technology for reclaiming, reprocessing and re-refining waste oils; (2) determine the sources, locations and quantities of waste oils in the State of Maryland; (3) provide a management program for collection and handling of all waste oil quantities including numbers of trucks, collection network, pickup and delivery scheduling, and storage points; (4) provide a preliminary financing plan with alternate methods of financing and management alternatives; and (5) perform preliminary engineering and prepare preliminary plans and specifications for the waste oil recovery system(s) in the State of Maryland, such that preparation of detailed plans and specs and construction may proceed immediately.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Demonstration of the Complete Conversion of Crankcase Waste Oil Into Useful Products Without Producing Pollutant Material			21AOI 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Solfred Maizus, President National Oil Recovery Corporation, P.O. Box 338 Bayonne, New Jersey 07002			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Keppler (Region I, EPA, Boston) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/70	12/15/73	☒ Contract ☐ Grant ☐ Intramural	Project Cost: Federal Cost: \$350,000 (70)	

TASK / PROJECT DESCRIPTION AND REPORTS

The principal objective of the project is to convert waste crankcase oil to a diesel oil and fuel oil with no solid or liquid wastes discharged to the environment. The National Oil Recovery Corporation vacuum-distillation process system shall be utilized and modified to produce a diesel fuel and a bottom product.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Study of Waste Auto Lubricants as Incinerator Fuel		21A01 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Steven H. Chansky, GCA Corporation GCA Technology Division Bedford, Massachusetts 01730		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard Keppler, (Region I, EPA, Boston) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
5/2/72	2/2/73	☒ Contract ☐ Grant ☐ Intramural	Project Cost: Federal Cost: \$29,441 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The contractor shall provide the necessary personnel, materials and facilities to conduct a study of the feasibility of using waste automotive lubricants to improve the municipal incineration combustion process. The purpose of the study is to examine the technical and economic feasibility of using waste oil in the incineration process. The Technical Study shall evaluate the burning characteristics of waste oil. The Economic Study shall evaluate the work necessary to determine the capital investment necessary to purchase and install an incineration system using waste oils.

BIODEGRADATION OF SPILLED OIL

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Microbiological Seeding to Accelerate Degradation of Hydrocarbons			21A0J A1	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Carl Oppenheimer, Marine Science Institute University of Texas Port Arkansas, Texas			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER F. T. Brezenski, (Region II, EPA, New York) Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
4/11/69	2/1/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$105,803 (68)

TASK / PROJECT DESCRIPTION AND REPORTS

Techniques will be developed to accelerate the natural degradation process of oil in marine waters. Selected cultures of microorganisms, nutrient material and additives to increase the oil surface area will be added to oil in the environment to increase the ratio of degradation by microbiological action.

ASSESSMENT OF DAMAGE DUE TO OIL SPILLED IN MARINE ENVIRONMENT

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development and Use of a Salt Marsh Microcosm as an Oil Pollution Research Tool			21APU 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Royal J. Nadeau Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/5/72	4/5/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$2,000	

TASK/PROJECT DESCRIPTION AND REPORTS

A salt marsh microcosm consisting of marsh sod excised from a nearby native salt marsh (Cheesapeake State Park) was established at the EWQRL. Plant growth and fauna development were monitored for six weeks, followed by contamination with low level concentrations of oil. Immediate fate of oil was monitored through chemical analysis and characterization of the hydrocarbon types found in the water column and sediments. Further monitoring during Phase II of the study will delineate chronic impact of the oil to the indigenous biota. The project itself will determine the feasibility of using microcosms to assess potential damage to natural ecological domains.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Marine Tunicate Response to Low Level Concentrations of Oils			21APU 02(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Royal J. Nadeau Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
11/15/72	11/15/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$4,000	

TASK/PROJECT DESCRIPTION AND REPORTS

A continuous flow system incorporating a dialysis cell and peristaltic pump was constructed to observe sublethal responses of the marine tunicate *Molgula manhattensis* (DeKay, 1843) to low concentrations of oil. This system was developed for screening small macro-invertebrate marine organisms for potential indicator species that could be used to delineate impact of an oil spill upon certain marine communities. During Phase II techniques will be developed for using other organisms (individuals and colonies) to determine sublethal responses to the presence of oil.

RESEARCH TASK/PROJECT TITLE Assessment of Intertidal Animals and Plants Following Contamination by Oil			FY1973 TASK NUMBER 21APU 09	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Cadet Hand, Bodega Bay Marine Laboratory University of California Bodega Bay, California 94923			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Royal J. Nadeau Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 5/1/71	EST. COMP. DATE 2/15/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$40,092 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

This project is an investigation to assess the repopulation of several intertidal sites which, prior to the San Francisco Bay Standard Oil Incident, were heavily populated with marine animals and plants, but, as a result of the incident, have suffered substantial loss through death and retardation. The assessment includes (1) a survey of each of the sites at bi-monthly intervals for a total of twelve (12) months to permit an estimate of repopulation; and (2) an estimate of the secondary impact of the oil spill on the disruption of the food web by examination of the sex organs and behavior of four intertidal marine organisms.

RESEARCH TASK/PROJECT TITLE Temperature Effects of Santa Barbara Crude Oil in the Upper Intertidal Zone			FY1973 TASK NUMBER 21APU 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Dale Straughan, Allan Hancock Foundation University of California Los Angeles, California 90007			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Royal J. Nadeau Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE 6/1/71	EST. COMP. DATE 2/15/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$14,590 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this study is to evaluate the temperature effects of oil in the intertidal zone on larval settlement and subsequent survival of these organisms. The information developed by this project will assist in determining and assessing the biological damage resulting from oil spills.

TREATMENT PROCESS DEVELOPMENT AND OPTIMIZATION 1B2043

OUTPUT: Process information for use in design of municipal and municipal-industrial wastewater treatment plants. Program efforts will be directed to: (1) develop new or improved technology for removal of pollutants; (2) develop charts and computer systems to facilitate design simulation and evaluation of individual treatment processes and systems of processes; (3) develop process control and instrumentation technology; and (4) develop new or improved methods for non-pollutional disposal of sludges and concentrated pollutants resulting from treatment processes. Operating and economic data from pilot and laboratory investigations will contribute to designs for demonstration facilities. The goal is total water reuse.

DEVELOPMENT AND DEMONSTRATION OF ACTIVATED GRANULAR
CARBON ADSORPTION PROCESSES

RESEARCH TASK/PROJECT TITLE Adsorption from Aqueous Solution			FY 1973 TASK NUMBER 21AAL 02(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Walter J. Weber, Jr., Dept. of Civil Engineering The University of Michigan Ann Arbor, Michigan 48104			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER C. A. Brunner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/69	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$44,995	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is the definition and description of adsorption phenomena associated with the uptake of organic pollutants from waters and wastewaters by active carbon, and the delineation of factors which govern rates and equilibria of adsorption from aqueous solution. The studies include a detailed investigation of the adsorption process and of the mass-transfer properties of different adsorption systems, and a detailed comparison of various conditions of operation from the points of view of efficiency and effectiveness of removal of persistent organic pollutants.

RESEARCH TASK/PROJECT TITLE Evaluation of 50,000 gpd Physical-Chemical Treatment			FY 1973 TASK NUMBER 21AAL 0204	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Leon Directo, Los Angeles County Sanitation District 2020 Beverly Boulevard Los Angeles, California 90057			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER I. J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 7/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$60,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this study are to evaluate a 50,000 gpd physical-chemical treatment system treating raw wastewater of domestic origin. Complete system performance including carbon exhaustion rates, the effects of regeneration on carbon capacity, and the effects of diurnal flow variation will be determined. This system is designed to simulate the 10 mgd Rocky Rover design including chemical coagulation with iron and alum followed by downflow single-stage carbon contacting. Effluent quality, coagulant, and polymer dosage, headloss and H₂S formation and control are being studied. Preliminary results indicate effluent TCOD's of less than 20 mg/l with soluble effluent COD's of less than 15 mg/l. After 14 million gallons of throughput, carbon loadings have reached 1.75# TCOD/#carbon. H₂S generation is being adequately controlled by the addition of 5 mg/l of nitrate nitrogen.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Effect of Feed Characteristics on Granular Activated Carbon Performance			21AAL 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James J. Westrick, Sanitary Engineer Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$25,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Clarified raw sewage will be fed to a battery of carbon columns connected in parallel. Flow rate and detention time will be maintained within the ranges used in typical physical-chemical plant design. Carbon performance will be evaluated in terms of treatment efficiency and carbon capacity. Parameters measured will be suspended solids, COD and TOC. Virgin carbon will be utilized at the start of each run. This year two runs are planned each of which should last approximately 4 months. During the first run the effect of pH will be evaluated. During the second, the effect of D.O. level will be studied. During the latter run upflow expanded bed operation will be utilized. In addition, it is planned that a report will be issued on the effect of the use of various coagulants for clarification prior to carbon treatment. This experimental work was completed in fiscal year '72. At the end of the first year it is expected that reports will be issued which will detail the effects of coagulant type, pH and dissolved oxygen on granular activated carbon performance.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Chemical Clarification and Carbon Filtration and Adsorption as Secondary Treatment for Rocky River Wastewater Treatment Plant - Cuyahoga County, Ohio			21AAL 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John H. Puzenski, Board of County Commissioners Cuyahoga County, 1219 Ontario Street Cleveland, Ohio 44113			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
8/16/68	12/31/75	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$250,000 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The project objectives are to demonstrate the practical application of the principles of chemical clarification and granular activated carbon filtration to provide a new method of treatment in lieu of conventional secondary treatment, to demonstrate the economic advantages of this system at a 10 MGD scale for communities with similar limited space, to demonstrate odor-free operation and to remove a significant amount of phosphate so that state requirements can be met.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Advanced Waste Treatment at Painesville, Ohio		21AAL 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Kenneth McDonald, City Manager City of Painesville, 7 Richmond Street Painesville, Ohio 44077		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James J. Westrick Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
12/15/69	6/15/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$684,500

TASK/PROJECT DESCRIPTION AND REPORTS

The project objectives are to demonstrate and evaluate a physical-chemical process for treating a combined municipal-industrial wastewater on a full-scale (5 MGD) level. The waste stream includes 0.5 MGD of oily waste from an oil additive manufacturer and chemical wastes from several other large industries that result in a combined waste that is difficult to treat biologically. The industrial wastewater is over one-half the total plant flow. The treatment train includes addition of lime or iron salts and polyelectrolyte to the primary clarifier; coarse sand filtration; granular carbon adsorption; chlorination; and carbon regeneration.

DEVELOPMENT AND DEMONSTRATION OF ACTIVATED POWDERED CARBON ADSORPTION PROCESSES

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Physical-Chemical Treatment of Municipal Waste			21AAM 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. L. Shell, Eimco Processing Machinery Division Envirotech Corp., 53, West Sixth South Salt Lake City, Utah 84110			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James J. Westrick Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
4/7/72	7/30/73	☒ Contract ☐ Grant ☐ Intramural		Federal Cost: \$340,000
TASK / PROJECT DESCRIPTION AND REPORTS				

The objective of this project is to determine on a pilot scale, the feasibility of the physical-chemical treatment of raw sewage by chemical coagulation and precipitation followed by adsorption by powdered activated carbon and dual-media filtration, including powdered carbon regeneration and reuse. This treatment combination should produce a high quality water with very low pollution load and with potential for a number of reuse possibilities.

DEVELOPMENT AND DEMONSTRATION OF MEMBRANE PROCESSES FOR THE
REMOVAL OF DISSOLVED INORGANICS AND/OR ORGANICS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Membrane Lifetime Study Using Spiral-Wound Modules			21AAP 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Ching-lin-Chen Los Angeles County Sanitation District Los Angeles, California			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John M. Smith Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	7/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$15,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to continue a membrane lifetime evaluation of a spiral-wound reverse osmosis module treating sand-filtered secondary effluent. A 10,000 gpd spiral-wound reverse osmosis unit has been operating at the Pomona Pilot Plant for 1-1/2 years treating sand-filtered secondary effluent. Flux decline, membrane cleaning techniques, membrane lifetime, and rejection performance are being investigated. No major operational difficulty has been encountered with this system since its start-up in April 1971. The salt rejection, flux, and recovery has declined from their original values of 95%, 15 gfd, and 85% to 80% 7.2 gfd and 73% respectively. This task is partially supported by in-house personnel as described in Task 21AAP 07.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Membrane Lifetime Study Using Spiral-Wound Modules			21AAP 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John M. Smith Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	7/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$17,500	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to continue a membrane lifetime evaluation of a spiral-wound reverse osmosis module treating sand-filtered secondary effluent. A 10,000 gpd spiral-wound reverse osmosis unit has been operating at the Pomona Pilot Plant for 1-1/2 years treating sand-filtered secondary effluent. Flux decline, membrane cleaning techniques, membrane lifetime, and rejection performance are being investigated. No major operational difficulty has been encountered with this system since its start-up in April 1971. The salt rejection, flux, and recovery have declined from their original values of 95%, 15 gfd and 85% to 80% 7.2 gfd and 73% respectively. (This in-house task supports the contract effort at the Pomona Pilot Plant as described in Task 21AAP 06).

DEVELOP NITRIFICATION AND DENITRIFICATION PROCESSES FOR NITROGEN
CONTROL/REMOVAL FOR NEW OR EXISTING TREATMENT PLANTS

RESEARCH TASK/PROJECT TITLE Nitrogen Removal by Biological Systems			FY 1973 TASK NUMBER 21AAT 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Dolloff F. Bishop (EPA-DC Pilot Plant) Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$32,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to evaluate nitrogen removal by the three stage activated sludge system and by a single stage activated sludge process with simultaneous BOD removal, nitrification and denitrification. The three stage activated sludge process consists of primary sedimentation, modified aeration with alum or FeCl₃ addition, nitrification, denitrification with methanol and alum addition, filtration. The single stage process includes a reactor with two basins in series, an optional denitrification basin for residual nitrate removal and a final gravity settler. The study emphasizes instrumentation and process control in the three stage system and process feasibility in the single stage activated sludge process. The in-house studies are coordinated with the District of Columbia studies on these systems at the EPA-DC Pilot Plant.

RESEARCH TASK/PROJECT TITLE Develop Nitrification and Denitrification Processes for Nitrogen Control or Removal			FY 1973 TASK NUMBER 21AAT 04(c)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER E. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 6/30/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$45,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to evaluate process options and engineering parameters related to the nitrogenous content of wastewater. Two pilot systems are used for process development. A dual train 50,000 gpd facility contains both trickling filter and activated sludge units. Piping arrangements are such that stage operation is possible in several modes. Small 200 gpd plastic units are used for initial feasibility screening studies.

Several stage approaches to controlling nitrification will be evaluated initially. These include modifications such as trickling filter followed by activated sludge, activated sludge followed by trickling filter, and chemical addition to primary tanks to reduce the organic load prior to biological nitrification. Comprehensive analytical control is necessary for obtaining high efficiency through understanding of mechanistic processes.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Pilot Plant Study of Nitrification on Plastic Media			21AAT 05(c)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Glenn Duddles, Dow Chemical Company, USA 2020 Dow Center Midland, Michigan 48640			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/70	2/1/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$185,569 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to determine the feasibility of using biological growths attached to plastic surface as a second-stage nitrification reactor, and to establish hydraulic application rates, mass loading, and temperature coefficients.

A 21-foot tower with a 3 foot diameter, located exposed to weather, was used for this investigation. Media packing consisted of surface sheeting. Secondary effluent from the Municipal Midland, Michigan Wastewater Treatment Plant was applied to the tower. Nitrified effluent from the tower was then filtered by use of a tri-media filter. A comprehensive analytical program was used to determine the profile of the various nitrogen species through the system.

At hydraulic application rates of 0.5 g/ft²/min., and temperatures above 10°C, a highly nitrified effluent could be produced. Because of the low net cell yield for this second-stage system, direct filtration of the tower effluent was possible. It was also established that with the addition of methanol, the tri-media filter could serve as a packed column denitrification system.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
El Lago Advanced Waste Treatment Facility			21AAT 05(e)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William Wilson, Harris County Water Control and Improvement District #50, 1122 Cedar Lane Seabrook, Texas 77586			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/15/70	8/14/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$173,304 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to institute high-quality treatment for removal of BOD, suspended solids, nitrogen, and phosphorus at an existing 0.3 mgd trickling filter plant.

The approach is to retain existing primary settler and trickling filter for BOD removal, add sequential stages of suspended growth nitrification and column denitrification, and provide positive solids control by terminal filtration before disinfection.

The major construction features were completed in November 1972. Phosphorus removal is accomplished via iron and polymer addition to the primary settler. The nitrogen control sequence has just gone on-stream and data evaluation is in progress.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Sludge Characteristics of Nitrogen Deficient Wastes			21AAT 05(F)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Anthony Geinopolos, Rex Chainbelt, Inc. P. O. Box 2022 Milwaukee, Wisconsin 53201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/1/70	8/1/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$122,780 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine the characteristic properties of waste activated sludge in response to various ratios of carbon to nitrogen in the influent wastewater.

Two parallel secondary systems are to be operated. One will be a "control" system and the other a "test" system for varying C/N ratios. Comparison of the resulting sludges will be made on the basis of subsidence, thickening and vacuum filtration. The "test" system will be varied over C/N ratios of 16:1, 33:1, 67:1.

Equipment installation and laboratory analyses set-up have been completed. The first C/N ratio to be studied will be the 67:1 ratio on the test system.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Three-Stage Activated Sludge for Nitrification Denitrification			21AAT 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alan B. Hais, Sanitary Engineer, Dept. of Env. Services Government of the District of Columbia, 415 12th St., NW Washington, D.C. 20004		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
10/1/72	10/1/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$40,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to evaluate system reliability with seasonal variations, to determine the kinetic rates of nitrification and denitrification at various wastewater temperatures, to provide design data with chemical requirements and, in coordination with an automation study, to develop instrumentation and process control automation for the system.

The system at the EPA-DC Pilot Plant consists of primary sedimentation, modified aeration with alum or FeCl_3 addition, nitrification, denitrification with methanol addition and alum addition and filtration. The system is operated at a nominal flow rate of 50,000 gpd with a maximum (rain) diurnal peak to average flow variation of 2:1. Instrument control loops (both analog and digital) are being developed for the chemical additions, pH control points and for D.O. control in the aeration basin.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Removal of BOD and Nitrogen in a Single Stage Activated Sludge System			21AAT 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alan B. Hais, Sanitary Engineer, Dept. of Environ. Serv. Government of the District of Columbia 415 12th Street, N.W., Washington, D.C. 20004		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
10/1/72	9/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$101,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives are to evaluate the feasibility of BOD removal, nitrification and denitrification in a single activated sludge system under varying seasonal conditions; to determine the effect of solids production and wasting on the nitrification and denitrification; and to determine the supplemental methanol requirements for complete denitrification. The single stage system employs alternating periods of cycling dissolved oxygen in which the D.O. varies from above 2 mg/l to essentially zero in a reactor operated at F/M ratios of 0.15 to 0.20 lb of BOD/lb of MLVSS/day. The cycling D.O. permits alternating nitrification and denitrification by the activated sludge mass. [Mixed liquor from the discharge of the reactor is recycled to the sludge mass.] Mixed liquor from the discharge of the reactor is recycled to the reactor influent to allow the BOD of the wastewater to serve as the carbon source for improved denitrification. The system includes an optional (1 hour detention) denitrification basin for methanol denitrification before the gravity settler.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Two-Stage Suspended Growth and Columnar Nitrification Studies			21AAT 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR J. Gasser Los Angeles County Sanitation District Los Angeles, California 90057		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	7/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$38,500

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this investigation is to operate a two-stage activated sludge system at a 2 mgd scale to verify process kinetics and to optimize system performance parameters such as contact time, clarifier overflow rates, sludge age, MLVSS concentration, D.O. levels and sludge wasting volumes. Effluent quality will be monitored and compared to a small parallel oxygen fed columnar nitrification system.

Preliminary results in the oxygen fed packed bed system indicate over 90% nitrification with an empty bed contact time of 30 minutes. (This task at the Pomona Pilot Plant is partially supported by in-house personnel as described in Task 21AAT 14.)

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Two-Stage Suspended Growth and Columnar Nitrification Studies		21AAT 14	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/72	7/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$15,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this investigation is to operate a two-staged activated sludge system at a 2 mgd scale to verify process kinetics and to optimize system performance parameters such as contact time, clarifier overflow rates, sludge age, MLVSS concentration, D.O. levels and sludge wasting volumes. Effluent quality will be monitored and compared to a small parallel oxygen fed columnar nitrification system.

Preliminary results in the oxygen fed packed bed system indicate over 90% nitrification with an empty bed contact time of 30 minutes.

(This in-house task supports the contract effort at the Pomona Pilot Plant as described in Task 21AAT 13.)

DEVELOP NITROGEN REMOVAL PROCESSES BY PHYSICAL OR CHEMICAL MEANS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Nitrogen Removal by Breakpoint Chlorination			21AAV 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Thomas A. Pressley Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$35,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of the study are to determine the kinetics of the breakpoint reactions as a function of pH, to evaluate breakpoint chlorination on influent wastewaters (limed) at pH's above 10, and to provide support to the automation of the chlorination process. Various wastewaters with NH_3 -N concentrations between 10 and 20 mg/l are chlorinated under control pH (base addition) to oxidize the NH_3 -N to N_2 . The kinetics of the oxidation of monochloramine to N_2 ($2 \text{NH}_2\text{Cl} + \text{HOCl} \rightarrow \text{N}_2 + \text{H}_2\text{O} + 3\text{HCl}$) are being determined by spectrophotometric methods. The breakpoint of high pH limed wastewater effluents require chlorine addition and then either small amounts of acid or base to produce the final reaction pH near 7.0. The information obtained is used for reactor design and to develop instrumentation and automation of the chlorination process.

DEVELOP HIGHER EFFICIENCY PROCESSES FOR PHOSPHORUS REMOVAL BY
CHEMICAL AND/OR BIOLOGICAL MEANS

RESEARCH TASK/PROJECT TITLE Develop Higher Efficiency Processes for Phosphorus Removal			FY 1973 TASK NUMBER 21AAW 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/30/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$65,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Several alternate systems for phosphorus control are extant, as are several modifications of secondary treatment. Much developmental work is needed to match phosphorus control systems with compatible secondary processes. Most phosphorus control technology leaves a residual phosphorus concentration of 1 mg/l. In some cases much lower residuals must be obtained.

200 gpd pilot units are to be used to study process combinations, such as extended aeration and mineral addition. Sludge properties, phosphorus removal efficiency, alkalinity relationships, and process control parameters are to be evaluated. Due to the low net biological solids production of extended aeration processes, the increased inorganic sludge production of the mineral addition technique for phosphorus control may be a limiting parameter for this combination of processes.

A pilot unit, operating at an organic loading of 0.1 pounds of COD per day per pound of MLVSS, with a detention time of 18 hours, is being dosed with 10 mg/l aluminum ion on a continuous basis. To date, the main process problem has been increased turbidity in the final effluent.

RESEARCH TASK/PROJECT TITLE The Use of Iron Salts and Organic Polymers for Removal of Phosphorus from Municipal Sewage			FY 1973 TASK NUMBER 21/AW 05(b)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Doris Van Dam, Wastewater Treatment Plant, City of Grand Rapids, 1300 Market Avenue, S.W. Grand Rapids, Michigan 49502			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/15/69	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$355,634	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to determine the optimum dosage of iron and polymer for efficient removal of phosphorus in the existing primary settlers of the 45 mgd treatment plant; operate treatment facility to obtain an effluent residual phosphorus content of 1 mg/l, or less; determine cost of process; and define operational variables necessary for efficient phosphorus removal.

An automated dual open loop system was installed to dose the entire influent plant flow, with ferric chloride in response to mass loading. An automated polymer system was installed to dose the influent flow with 0.2 mg/l of polymer. A comprehensive analytical program was instituted.

Residual effluent phosphorus levels of 1 mg/l or less are difficult to obtain at the existing facilities, primarily because of high weir overflow rates in the final tanks. The iron salt effectively insolubilizes the phosphorus but residual solids increase the total phosphorus content to 2-3 mg/l. Phosphorus in the various process outlets is accounted for on a mass balance basis.

RESEARCH TASK/PROJECT TITLE Hatfield Township Advanced Waste Treatment Facility			FY 1973 TASK NUMBER 21AAW 05(c)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Tracy Greenlund, Hatfield Township Municipal Authority P. O. Box 2 Colmar, Pennsylvania 18915		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/1/71	EST. COMP. DATE 4/31/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$126,878 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

This project provides for the demonstration, analysis and evaluation of the Hatfield Township advanced waste treatment plant which must produce a high quality effluent for discharge to the Neshaminy Creek.

BOD₅, NOD, suspended solids and phosphorus will be controlled by an integrated series of unit processes including lime precipitation, biological nitrification, tertiary coagulation and filtration. Equalization tanks are used to provide constant flow to the advanced processes.

Presently the plant is in the shake-down stage for equipment and process capability. Background analytical data on wastewater quality and receiving water quality are being collected. Bids for chemical supplies have been let, and operator training is in progress.

RESEARCH TASK/PROJECT TITLE Improved Liquid-Solids Separation by Use of Aluminum Compound in Activated Sludge Treatment			FY 1973 TASK NUMBER 21AAW 05(f)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Timothy Troutman, County of Greene, Xenia, Ohio P. O. Box 116 Alpha, Ohio 45301		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/4/69	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$48,548

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to demonstrate that more efficient liquid-solids separations can be affected when a weighting agent, such as alum or sodium aluminate is added to wastewater undergoing secondary treatment. Considerable improvement in phosphorus removal capability will be an incidental benefit.

Install chemical storage tanks and chemical pumps to dose the 2 mgd Greene County plant with aluminum compounds, and to maintain chemical dosage, in relation to flow variation, to obtain 10 mg/l of aluminum ion in primary effluent flow.

Currently, progress has been retarded due to a capital expansion program to double the plant capacity for secondary treatment. Background analytical data collection and systems check-out is in progress.

RESEARCH TASK/PROJECT TITLE Demonstration and Pilot Plant Program for Secondary and Advanced Waste Treatment			FY 1973 TASK NUMBER 21AAW 05(g)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Peter F. Mattei, Metropolitan St. Louis Sewer District 2000 Hampton Avenue St. Louis, Missouri 63139		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Edwin F. Barth Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/1/71	EST. COMP. DATE 5/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$208,800 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to demonstrate and compare the effectiveness and relative costs of various processes for secondary and advanced treatment of weak combined wastewater and strong industrial-domestic wastewater.

The approach is to employ pilot and full-scale of candidate processes such as high purity oxygen aeration and metal salt addition for phosphorus removal, and to determine mass loading of various wastewater constituents by programmed sampling and analytical schemes.

Oxygen aeration proved very effective for the industrial-domestic waste with a high soluble BOD content. Programmed sampling has shown the mass loading profile through the existing facilities.

RESEARCH TASK/PROJECT TITLE Phosphorus Removal in Physical-Chemical Treatment			FY 1973 TASK NUMBER 21AAW 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C., 20032	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$40,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of the study includes the determination of the kinetics of precipitation (and flocculation) of $\text{Ca}_5\text{OH}(\text{PO}_4)_3$, CaCO_3 , and $\text{Mg}(\text{OH})_2$ in lime treatment of raw wastewater and the evaluation of phosphorus removal by a short detention (4 hours) physical chemical treatment system. The laboratory kinetics performed with equilibrated (EPA-DC Pilot Plant) lime sludges provides overall rates for precipitation (and flocculation to greater than 0.45 μ particles) at various pH, temperature, and reactor solids (recycled) concentrations. The short detention physical chemical treatment system consists of single stage lime- FeCl_3 treatment at about pH 10, breakpoint chlorination, carbon adsorption and filtration with alum addition ahead of the filters. Alum at doses of 20 mg/l in early work provides phosphorus residuals after the final filters of about 0.1 mg/l as P.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Phosphorus Removal in Biochemical Systems at the EPA-DC Pilot Plant		21AAW 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alan B. Hais, Dept. of Environmental Services Government of the District of Columbia 415 12th St., N.W., Washington, D.C. 20004		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
10/1/72	9/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$40,00

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives are to evaluate phosphorus removal by mineral addition (FeCl_3 and alum) in the three-stage activated sludge system for nitrification-denitrification and in a single stage activated sludge system with simultaneous BOD removal, nitrification and denitrification; to evaluate Technicon sensors for continuous phosphorus measurement in the pilot processes; and to determine the effects of the mineral addition (pH and solids wasting) on the nitrification-denitrification processes within the treatment systems. In the three-stage system, the FeCl_3 is added to the first stage (modified aeration) at a dosage of about 1.2:1 Fe/P and alum is added to the third stage (denitrification) at a dose of 3 to 4:1 AL/P. Phosphorus residuals of about 0.1 mg/l as P are achieved after filtration of the denitrified effluent. Alum will be added at various AL/P ratios to the last pass of the single stage system to determine the phosphorus removal and the effect of pH reduction and increased solids wasting on the nitrification and denitrification in the system.

USE OF HIGH PURITY OXYGEN AND MINERAL ADDITION FOR PHOSPHORUS REMOVAL

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Alum Addition in Oxygen Activated Sludge			21AAX 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
7/1/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural		Federal Cost: \$5,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to evaluate phosphorus removal by alum addition in a "plug flow" oxygen activated sludge system, to determine the effects of the phosphate precipitate and $AL(OH)_3$ formation on the settling characteristics of the oxygen activated sludge mixed liquor and to determine the amount of lime required to prevent the alum addition from reducing the pH of the wastewater effluent from the oxygen activated sludge process.

The study is part of an overall study of oxygen activated sludge at the EPA-DC Pilot Plant. Alum is added to the final pass of an oxygen activated sludge reactor at AL/P ratios from 1:1 to 2:1. Lime is added to prevent the effluent pH (normally in the pH range of 6.3 - 6.6) from decreasing further with the alum addition. The studies to date have revealed phosphorus removals of about 80%. The work is continuing to determine maximum phosphorus removals at higher alum doses and to determine effects of alum addition on the settling characteristics of the mixed liquor.

SUSPENDED AND COLLOIDAL SOLIDS REMOVAL BY FILTRATION PROCESSES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
The Role of Polyelectrolytes in Filtration Processes			21AAZ 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR C. R. O'Melia, School of Public Health University of North Carolina Chapel Hill, North Carolina		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Sidney A. Hannah Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
9/1/70	2/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$25,400 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to investigate destabilization of particulate matter and attachment of such solids to media during in-depth filtration. Basic mechanisms and methods for dosage control of filter aids for application to water and wastewater treatment will be determined.

Experimental work is complete and the final report is being prepared.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Evaluation of In-Depth Filtration for Wastewater Treatment Using a Mobile Pilot Plant			21AAZ 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Timothy G. Shea, Engineering-Science, Inc. 158 East Foothill Boulevard Arcadia, California 91006		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
4/13/70	6/13/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$127,610 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop design and operating criteria for in-depth filtration as applied to the treatment of various wastewaters for the purposes of clarification and/or phosphorus removal. Various coagulants, modes of filter operation and degrees of pretreatment will be evaluated to achieve different levels of product quality for activated sludge, trickling filter and primary effluents. A profile of application for in-depth filtration will be developed. A unique feature of the proposed research is development of an accurate process control technique.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Filtration Kinetics in Water and Wastewater			21AAZ 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Erman A. Pearson University of California Berkeley, California 94720		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
8/1/69	6/30/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$43,350 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to improve the design and operation of granular media filters based upon the development of an accurate description of filtration kinetics. This kinetic description of the filtration system will also lead to the development of new areas of application of granular media filtration in wastewater treatment. This research is directed towards answering the two fundamental questions: (1) what is the best way to design filtration systems given a water or wastewater of known quality and a desired effluent quality; and (2) what is the best way to improve the efficiency of existing filtration systems.

These objectives will be achieved by investigating the physical and chemical factors which control filter performance through granular media for the removal of colloidal or flocculent particles within the size range of 5 to 50 microns.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Hanover Tertiary Plant Studies			21AAZ 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Cecil Lue-Hing, Metro. San. Dist. of Greater Chicago 100 E. Erie Street Chicago, Illinois 60611		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
5/1/68	3/1/73	☐ Contract ☒ Grant ☐ Intramural		Federal Cost: \$263,182 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to evaluate the performance of various combinations of chemical treatment, rapid sand filtration, microstraining, chlorination, and post oxidation for a 1 MGD tertiary treatment plant, and to evaluate the performance of up and down flow sand filters, ion exchange units, and ammonia separators on a pilot-plant scale.

The final report on this project is being reviewed.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
New Process to Improve Quality of Trickling Filter Effluent		21AAZ 09	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Michael S. Kachorsky Borough of Manville Manville, New Jersey		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER William Librizzi Edison Water Quality Research Lab NERC-Cincinnati, EPA, Edison, New Jersey	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
8/12/68	3/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$490,000 (68)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to demonstrate the feasibility of a Moving Bed Filter (MBF) for continuous treatment of trickling filter effluent on a full-scale operation. Four automated MBF units of .5 MGD capacity will be installed for clarification of trickling filter effluent. The principle of the filter is the use of a continuous countercurrent sand filter bed in which the sand is cleaned and recycled. Movement in the filter is accomplished by a hydraulic diaphragm.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Performance Analysis of 15 MGD Microstrainer for Tertiary Treatment		21AAZ 13	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Cecil Lue-Hing, Metro. San. Dist. of Greater Chicago 100 East Erie Street Chicago, Illinois 60611		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
9/1/72	10/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$148,927

TASK / PROJECT DESCRIPTION AND REPORTS

The Metropolitan Sanitary District of Greater Chicago plans to install a 15 mgd microstrainer for tertiary treatment at their North Side Treatment Plant. This will be the largest such facility in this country, and will afford the Environmental Protection Agency an opportunity to verify its mathematical model development and obtain realistic cost and performance information on a large-scale plant. The facility is designed to meet an effluent quality criteria of 5.0 mg/l of suspended solids and 4.0 mg/l of 5 day BOD at a feed concentration of 18.0 mg/l of suspended solids and 13.0 mg/l of BOD.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Backwash of Granular Filters Used in Wastewater Treatment			21AAZ 18
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR J. L. Cleasby, Professor of Civil Engineering Iowa State University Ames, Iowa 50010		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
9/1/71	3/15/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$40,923
TASK/PROJECT DESCRIPTION AND REPORTS			

The project is designed to address, through laboratory and pilot studies, several areas of uncertainty in the practice of wastewater filtration. Some of these areas being studied include: (1) the optimum degree of expansion for backwashing of mono-, dual- and tri-media filters; (2) the optimum degree of intermixing of the various media in terms of filter effluent quality and headloss development; (3) predictive method development, using readily-measurable media properties, for the design of filters with optimum mixing and expansion characteristics; and (4) determination of optimum air scour and other auxiliary backwashing techniques.

SUSPENDED AND COLLOIDAL SOLIDS REMOVAL BY SEDIMENTATION PROCESSES

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Investigation of Performance of Tube Settlers			21ABA 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER E. T. Oppelt (Lebanon Pilot Plant) Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	7/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$25,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to evaluate the ability of shallow bed clarification devices, when installed in an existing clarifier, to absorb the hydraulic stress experienced by the clarifier during peak flow and continuous hydraulic overload conditions. Other objectives are to obtain long term operating and maintenance cost data and some concept of the economic advantages and disadvantages associated with shallow bed clarification.

A shallow bed clarification device (a Neptune MicroFloc settling tube assembly) will be installed in one of the two parallel settling basins at the Lebanon Sewage Treatment Plant, with the unmodified basin serving as a control. The performance of each basin will be evaluated for solids capture ability under normal and stressed conditions. Information will also be gathered from which it will be possible to predict the operating and maintenance costs and problems associated with the basin.

The construction of the settling tube installation is currently nearing completion. The evaluation will likely begin in late January or early February 1973.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Evaluation of Shallow Bed Gravity Clarification			21ABA 05(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Stuart L. Davis, Neptune MicroFloc, Inc. P. O. Box 612 - 1965 Airport Road Corvallis, Oregon 97330		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. V. Villiers Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
10/6/72	1/5/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$39,102	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this contract is to design and install a Neptune MicroFloc Inc., settling tube device in the West final settling basin of the City of Lebanon, Ohio wastewater treatment plant. The device will be designed to provide sedimentation for 750,000 gpd with an effluent suspended solids content not to exceed 20 mg/l. The installation will include all necessary modifications to the existing basin, provision for tube cleaning, and installation of flow measurement from each of the two basins, original and modified. A manual of operation will be provided and the unit will be performance tested before release for an in-house investigation by staff at the Lebanon Pilot Plant, AWTRL.

SUSPENDED AND COLLOIDAL SOLIDS REMOVAL BY FLOTATION PROCESSES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Air Flotation for Solids Separation			21ABB 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James F. Kreissl Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	12/31/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$12,500	

TASK/PROJECT DESCRIPTION AND REPORTS

The project involves an extensive literature search resulting in the production of a state-of-the-art review of the process.

DISSOLVED BIODEGRADABLE ORGANICS REMOVAL BY PURE OXYGEN AERATION PROCESSES

RESEARCH TASK / PROJECT TITLE Demonstration of the Oxygen Aeration Process to Upgrade Existing Waste Treatment Plants			FY1973 TASK NUMBER 21ABE 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William Pressman, Administrative Engineer New York City Dept. of Water Res., 40 Worth Street New York, New York 10013		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/30/70	EST. COMP. DATE 5/1/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$250,000 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The major objectives of this project are to demonstrate that oxygen aeration can be applied without expansion to upgrade an existing modified air aeration activated sludge plant from 75% treatment to 90%+ treatment and that a molecular sieve oxygen gas generation unit can be successfully integrated into the total process to supply oxygen requirements. One 20 mgd bay was isolated from 15 other similar bays of New York City's Newtown Creek modified aeration plant and converted to the Union Carbide submerged turbine-sparger oxygen aeration option. A 15 ton/day Pressure Swing Adsorption oxygen generation plant was installed along with a liquid oxygen backup supply system. After system startup and shakedown, a one-year demonstration run was commenced in mid-September 1972. Early results indicate that effluent BOD₅ and suspended solids concentrations of approximately 10 and 15 mg/l, respectively, are being produced in the oxygen test train at a constant flow of 20 mgd (equivalent to an aeration detention time based on raw wastewater flow of 1.4 hours). Corresponding F/M and volumetric organic loadings approximate 0.7 lb BOD₅ applied/day/lb MLVSS and 150 lb BOD₅ applied/day/1000 ft³, respectively. In contrast, the remainder of the plant (the 15 unconverted bays) is producing an effluent with average BOD₅ and suspended solids concentrations of about 30 and 40 mg/l, respectively, at a nominal aeration based on raw wastewater flow of 2.5 hours. Oxygen train performance is currently being evaluated under diurnal flow variations. Subsequent phases will determine the ultimate organic and/or hydraulic loading capacity of the oxygen train and phosphorus removal efficiencies possible via mineral addition to the oxygen aerator.

RESEARCH TASK / PROJECT TITLE A Simplified Method of High Purity Oxygen Injection into Activated Sludge Processes			FY1973 TASK NUMBER 21ABE 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Ralph Wagner, Chief Sanitary Engineer Las Virgenes Mun. Water Dist., 4232 Las Virgenes Road Calabasas, California 91302		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/71	EST. COMP. DATE 9/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$157,549 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to demonstrate upgrading of an existing air aerated activated sludge plant with a simplified single-stage oxygen contact system, using existing aeration tanks, blowers, and diffusers to greatly reduce the cost of dissolution equipment. A 2 mgd aeration bay at the Las Virgenes Municipal Water District Tapia Water Reclamation Facility has been converted to a single-stage oxygen system using an inflated oxygen tent tank cover to contain the oxygen-rich atmosphere over the aerator. A conventional centrifugal air blower, corrosion proofed on the suction side and modified to be compatible with oxygen gas, is used to recirculate gas from within the tent cover through conventional coarse bubble spiral roll air diffusers. Virgin oxygen is introduced to the system through a fine bubble sparger. The system is currently being evaluated on a one-year demonstration run. One conservatively-designed phase (nominal aeration time based on raw wastewater flow = 9.5 hours) has been completed to date, to determine if effluent acceptable for agricultural recycle could be produced. Effluent quality for the phase averaged $\text{POD}_5 = 2 \text{ mg/l}$, COD = 35 mg/l, suspended solids = 9 mg/l and was complete nitrified. At the high sludge age (>70 days) induced by this type of operation, total biological sludge production was virtually nil. However, the reduced sludge wasting pattern permitted a buildup of grease and other poor settling debris, thereby deteriorating sludge settling characteristics (SVI = 200 ml/gram $\pm$). Subsequent phases of the experimental program will examine system performance and sludge characteristics at 4 and 2 hours of nominal aeration time (based on raw wastewater flow).

*For Grantee: Las Virgenes Mun. Water District
4232 Las Virgenes Rd., Calabasas, California 91302

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Open Tank Oxygenation System for Accelerated Sewage Treatment			21ABE 11
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Duane M. Parker, Martin Marietta Corporation P. O. Box 179 (Mail No. 1642) Denver, Colorado 80201		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
9/25/72	9/24/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$142,483

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to develop a technically feasible and economically attractive open-tank oxygen aeration activated sludge system. An ultra-fine (<0.2 mm) bubble diffuser, developed by Martin Marietta Corporation, will be evaluated for feasibility of dissolving oxygen gas and obtaining a high overall oxygen utilization factor in an open-tank activated sludge aerator. (Commercially available oxygen aeration system to date have all utilized covered-tank aerators.) The diffuser works on the shear principle with mixer liquor continuously recycled through the diffuser at right angles to injected oxygen gas. To be economically realistic, 90% or greater of the oxygen bubbles must dissolve before rising to the aerator liquid surface. This concept will be evaluated in a 30 gpm pilot plant located on the grounds of a suburban Denver wastewater treatment plant. At the date of this writing, the 30 gpm pilot plant is in the process of being fabricated. A one-year experimental program will commence in spring 1973 after installation and "shakedown."

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Oxygen Activated Sludge Studies on Primary, Secondary and Raw Wastewaters			21ABE 17
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alan B. Hais, Dept. of Environ. Services Government of the District of Columbia 415 12th Street, N.W., Washington, D.C.		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032-NERC-Cincinnati, O.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
10/1/72	9/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$50,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of the study are to evaluate air flotation as an alternate to gravity settling in an oxygen activated sludge process with conventional plug flow of primary effluent; to evaluate step feeding of primary effluent into the oxygen activated sludge reactor; to evaluate the conventional "plug" flow operation on D.C. raw wastewater; and to evaluate oxygen nitrification of D.C. secondary (modified aeration) effluent. Each of the two oxygen activated sludge systems consists of 4 totally mixed stages to approximate "plug" flow in the reactor and includes external oxygen recirculation within each stage and co-current oxygen-wastewater flow between stages. The study provides product quality, sludge production, kinetic rates of nitrification and solids separation characteristics. To date, air flotation clarification did not produce satisfactory suspended solids in the effluent from the clarifier as compared to gravity clarification.

RESEARCH TASK / PROJECT TITLE Evaluation of Expanded Bed Biological Treatment		FY 1973 TASK NUMBER 21ABE 24	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER E. T. Oppelt Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 7/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$55,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this work is to develop information on the feasibility of a three-phase (oxygen-media-water) fluidized bed contacting system for the biological oxidation of soluble organic wastes using pure oxygen. The process efficiency will be thoroughly evaluated and compared to the best state-of-the-art competing suspended-growth waste treatment system. The advantages of the system will be defined and design data will be generated to permit scale-up and eventual full scale demonstration of the process. The project involves six distinct phases: (1) literature search; (2) construction of a 10 gpm pilot unit; (3) optimization of system hydraulics, selection of media; (4) determine system kinetics, operating methods, maximum performance; (5) construct and test the concept at the 100 gpm scale; and (6) demonstration of the process at the 2-5 mgd scale. Phases I, II, and III are completed and Phase IV will be completed June 30, 1973. A columnar system using eight 10" x 12' columns is currently being run on primary treated wastewater using 0.5 mm sand as the bed media. Soluble COD removals of 71% have been achieved with an empty bed contact time of 30 minutes. Final effluent quality ranges between 17 and 37 mg/l soluble COD. Pending on economic analysis and further evaluation of process kinetics, it is planned to proceed with Phase V.

DISSOLVED BIODEGRADABLE ORGANICS REMOVAL BY ROTATING BIOLOGICAL CONTACTOR PROCESSES

RESEARCH TASK / PROJECT TITLE Demonstration of the Rotating Biological Disc Method of Waste Treatment			FY 1973 TASK NUMBER 21ABF 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR David L. Kluge, Admn. Engineer Village of Pewaukee, 226 Oakton Avenue Pewaukee, Wisconsin 53072			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert L. Bunch Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/15/69	EST. COMP. DATE 2/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$353, 972 (70)	

TASK / PROJECT DESCRIPTION AND REPORTS

The project is to demonstrate and evaluate the effectiveness and efficiency of the Rotating Biological Contactor Process (RBC) for treating municipal wastes on a full-scale community level. The performance of the RBC will be compared directly with an existing trickling filter under identical conditions. Eleven months of operating data have been collected. During this period the raw wastewater averaged 118 mg/l and the final effluent averaged 20 mg/l giving an 83% removal. Nitrification was experienced when the plant was lightly overloaded. It is projected that additional funds will be allocated to this project to evaluate phosphorus removal on discs via mineral addition.

RESEARCH TASK / PROJECT TITLE Evaluation of the Performance of the Biological Disc Treatment Plant			FY 1973 TASK NUMBER 21ABF 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR William A. Sack, Associate Professor Dept. of Civil Engineering, West Virginia University Morgantown, West Virginia 26506			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert L. Bunch Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/1/72	EST. COMP. DATE 2/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$16,194 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to monitor a 6.2 gpm biological disc treatment plant at a summer recreation camp. In addition to determining the common parameters of performance, the amount of time spent on maintenance and operation is to be recorded.

Under daily flows that vary from 1600 to 6000 gpd the unit produces an effluent with less than 10 mg/l of suspended solids. BOD₅ removal ranges from 73 to 97% with an average of about 90%. Best estimates indicate that the daily water consumption at a facility of this type is about 35 gpcd. The final report is in preparation.

DISSOLVED BIODEGRADABLE ORGANICS REMOVAL BY UPGRADING AIR ACTIVATED SLUDGE PROCESS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Reclamation of Wastewater by Controlled Biological Kinetics			21ABG 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Donald Feuerstein, Lab Director Engineering Science, Inc., 4144 Telegraph Avenue Oakland, California 94609			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
1/67	7/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$145,612 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to develop an accelerated high rate activated sludge process and documentation of kinetic relationships which define performance; and, to apply this performance toward greater substrate loading capacities, thereby reducing the size of biological installation as well as increasing contaminant removals. A 3 MGD (total flow) biological plant designed for steady or diurnal flows and for loading rates up to 30 lbs BOD/lb of MLVSS/day, was constructed and operated for 13 months. Provisions were added for chemical addition at any point in the system. Various solid-separations devices were tested on full and pilot scale basis. Increased substrate loading rate as well as increased temperature, tends to stimulate growth of filamentous organisms. Bound water content varies with growth rate, thus extremely high growth rate sludges and filamentous sludges have high bound water contents. In terms of substrate loadings, filamentous sludges remove same amounts of BOD as conventional sludges, and tend to increase removal of N and P; however, colloidal materials are not as efficiently removed. The major problem in high rate systems is the separation of solids (sludge) from the liquid phase. Various solids-liquid separation devices were tested. Vibrating screens were ineffective. Picket fences in the secondary clarifier concentrated the sludge by a 3-fold factor. The most effective approach was dissolved air flotation.

*For Grantee: City of Chino, Central at "D" Street
Chino, California 91710

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Actinomycetes of Sewage Treatment Plants			21ABG 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Hubert A. Lechevalier, Prof. of Microbiology Rutgers University, The State Univ. of New Jersey New Brunswick, New Jersey 08903			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald F. Lewis Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
3/1/71	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$33,278 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to determine the systematic position of actinomycetes growing in sewage treatment plants and to investigate the ecological factors responsible for the growth of these organisms in sewage treatment plants. The ultimate aim is to obtain basic information that will permit the development of a rational approach to the control of troublesome mycelial mat formation in the aeration tanks of activated sludge systems. This nuisance mat formation may become up to two feet thick on the surfaces of some aeration tanks and large chunks may break off and travel through the clarifier and into the final effluent.

Over 120 species of *Nocardia* have been isolated from the actinomycete foams. Many may be atypical strains of *N. asteroides*. Work is in progress at the Pasteur Institute in Paris to determine if the sewage actinomycetes exhibit the pathogenicity of typical strains of *N. asteroides* isolated from patients with nocardiosis. Factors affecting the growth of these *Nocardia* such as types of substrate, amounts of inocula needed, and operating procedures of the activated sludge plants have also been briefly studied.

RESEARCH TASK/PROJECT TITLE Measurement of Active Biomass Concentrations in Biological Waste Treatment Processes			FY 1973 TASK NUMBER 21ABG 09	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Frederick G. Pohland, Prof. of Civil Engineering Georgia Institute of Technology Atlanta, Georgia 30332		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald F. Lewis Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 9/1/70	EST. COMP. DATE 9/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$23,458 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of the research is to define the applicability and limitations of the dehydrogenase assay for measurement of the active biomass associated with biological treatment of domestic and industrial wastewaters. The specific objectives are: (1) to study the effects of varying organic content and nutritional deficiencies on the dehydrogenase activities of biological sludges; (2) to study the relationship between the active biomass concentrations and dehydrogenase activities of biological sludges undergoing endogenous metabolism; and (3) to develop a laboratory procedure for correlating dehydrogenase activities with the active biomass concentrations of biological sludges obtained from prototype and industrial treatment processes.

The studies have been conducted with pure cultures of bacteria and mixed cultures in batch and continuous flow systems using a variety of defined food materials or actual wastes. The range of dehydrogenase enzyme activity under the varying conditions has been established as well as a definite correlation between dehydrogenase activity and ATP content of the cells.

RESEARCH TASK/PROJECT TITLE High Performance Bio-Treatment of Municipal Sewage			FY 1973 TASK NUMBER 21ABG 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Carl Beer, Senior Research Scientist New York State Dept. of Environmental Conservation Albany, New York 12201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 6/21/68	EST. COMP. DATE 12/31/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$371,125 (68)	

TASK/PROJECT DESCRIPTION AND REPORTS

The project objective is to develop a high-rate biological treatment process and other related process units that is, especially for smaller communities, compatible with modern requirements and technology. A novel 120,000 gpd pilot plant has been constructed on the grounds of the New York State Vocational Institute in West Coxsackie, New York, to treat the sewage of the resident inmate population. The treatment facilities consist of an aerated equalization tank, a two-stage split-culture activated sludge regime, intermediate upflow activated sludge clarifiers, multi-compartment horizontal flow (with inclined trays) final clarifiers, a multi-compartmented tank for batch aerobic digestion of waste activated sludge, and Purifax equipment for high pressure chlorination treatment of primary sludge.

A two-year experimental development program has recently begun in which the above facilities will be evaluated in various sequences to optimize treatment of small (but widely varying) flows for maximum removal of organic carbon materials, suspended solids, phosphorus, and nitrogen. The results of this project will have greatest application to small communities with typical broad-swing diurnal flow patterns.

RESEARCH TASK / PROJECT TITLE Demonstration of the Replacement of Secondary Clarifiers by Dynamic Straining			FY 1973 TASK NUMBER 21ABG 11
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Warren G. Falmer, Staff Engineer FMC Corp., Environmental Engineering Laboratories P.O. Box 698, Santa Clara, California 95052		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 3/15/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$63,149 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The immediate objective of this project is to evaluate the technical and economic feasibility of clarifying activated sludge mixed liquor by means of ultrasonically excited rotating micromesh strainers. The ultimate objective of the strainer concept is to demonstrate consistent performance and production of highly clarified secondary effluent which will justify the replacement of gravity settling basins for liquid/solids separation of mixed liquor. A 10 gpm pilot plant has been outfitted with two rotating strainers; a primary strainer and a secondary strainer. The primary strainer is immersed directly in the mixed liquor and is designed to produce an intermediate quality effluent of 50 mg/l suspended solids or less. Strained solids are continuously removed from the primary strainer fabric by the rotational effect and ultrasonic energy and are retained in the aerator. Primary strainer effluent is fed to the secondary strainer unit located in a small external receiver tank. The secondary strainer hopefully will further reduce suspended solids to an acceptable level of 20 mg/l or less. Solids shed by the secondary strainer are recycled to the aerator. Activated sludge wasting is done directly from the aerator. Installation was complete and the system in the final stages of startup and "shakedown" as of the end of 1972. The strainer units will be evaluated for initial feasibility for a period of three months utilizing varied rotational speeds, driving heads, and fabric types.

RESEARCH TASK / PROJECT TITLE Microscopic Examination of and Characterization of Batch Flux Settling Properties of Activated Sludges			FY 1973 TASK NUMBER 21ABG 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Ronald F. Lewis Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/71	EST. COMP. DATE 6/30/76	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to: (1) study the organism types and population mixes of activated sludges from pilot and full-scale plants that cause nuisance effects such as bulking of activated sludges or massive mycelial mat scum formation on activated sludge tanks; and (2) determine the effect of seasonal changes, if any, on activated sludge settling rates (both air and oxygen aeration) and the relative settling rates of air and oxygen activated sludges at similar concentrations and sludge ages. Approaches utilized are: (1) identification of factors influencing growth of nuisance organisms via microscopic examination and instituting changes in activated sludge plant operation; and (2) conducting periodic batch flux settling tests with 6-inch, 8-ft long stirred columns on both air and oxygen activated sludges at full-scale operating plants. Experience indicates that nuisance organisms usually causing the greatest operating problems are bacteria of the Sphaerotilus-Leptothrix group, the filamentous sulfur bacteria Thiothrix and Beggiatoa, and the filamentous Nocardia species. Successful methods of controlling these organisms have included air stripping of H₂S from primary effluents to prevent growth of Beggiatoa or Thiothrix adjustment of the C/N ratio or D.O. level of the activated sludge mixed liquor to minimize growth of the Sphaerotilus-leptothrix bacteria and adjustments of the MLVSS and sludge age to achieve a young vigorously growing activated sludge to minimize nuisance nocardia growths. As of the end of 1972, column fabrication for performing the batch flux settling tests was just being completed. Between six and ten trips will be made to each of several full-scale sites to evaluate the settling properties of oxygen and air sludges over the complete range of seasonal wastewater temperatures.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Performance Comparison of Commonly Used Activated Sludge Flow Regimes			21ABG 13	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
7/1/72	6/30/75	☐ Contract ☐ Grant ☒ Intramural		Federal Cost: \$66,250

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to define comparative substrate removal rates, sludge production rates, sludge settling characteristics, and overall performance of commonly used activated sludge flow regimes. Reliable data is extremely scarce in the literature in which different activated sludge flow regimes have been evaluated in parallel on the same wastewater. Generally, capabilities of these various regimes have been delineated through a history of isolated and unrelated studies. This project will attempt to confirm kinetic rates shown in the literature for three or four of the regimes by utilizing pilot plants to compare plug flow, complete mix, step aeration, and possibly contact stabilization processes on a common wastewater source. As of the date of this writing, one conservative loaded phase (6 hours nominal aeration time based on raw wastewater flow) had been completed with comparable performance in the three trains (plug flow, complete mix, step aeration) now being operated. Subsequent phases will utilize detention times of 4, 3, 2, and 1 hours of nominal aeration time. Further plans call for scaling up of this comparative examination (now being conducted in Cincinnati) in FY '74 using the larger pilot plant facilities available at the joint EPA/DC Blue Plains Pilot Plant in Washington, D.C.

DISSOLVED BIODEGRADABLE ORGANICS REMOVAL BY UPGRADING TRICKLING
FILTER PROCESSES AND MODIFICATIONS

RESEARCH TASK / PROJECT TITLE A Demonstration on Enhancement of Effluent from a Trickling Filter Plant			FY 1973 TASK NUMBER 21ABH 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *James E. Laughlin, Partner Shimek, Roming, Jacobs & Finklea Consulting Engineers 2118 Adolphus Tower, Dallas, Texas 75202			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/23/69	EST. COMP. DATE 2/24/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$27,852 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project was to demonstrate that the performance of standard-rate trickling filters as measured by BOD, suspended solids, and phosphorus removals, could be upgraded by the judicious application of chemical supplements within the basic process. The approach taken consisted of several trial runs in which two metallic salts (liquid alum and liquid ferric chloride) were dosed separately and in combination with polymer at several points in the flow pattern (notably just ahead of the primary clarifier and just ahead of the secondary clarifier) followed by a one-year demonstration run utilizing the most favorable chemical dosing sequence. Results of this project revealed the greatest improvement in overall plant (scale, 1 mgd) performance was afforded by a controlled dose of liquid alum to the main process flow stream in the mole ratio of Al/P = 1.5/1.0 to 1.7/1.0 just after passage through the trickling filters but prior to entrance to the secondary clarified center feed well. Precipitation of phosphorus, coagulation, and flocculation of solids, and efficient liquid/solids separation all were accomplished within the secondary clarifier. Recirculation of settled trickling filter humus and chemical sludge to the raw sewage wet well in turn improved performance of the primary clarifiers and decreased organic loading to the trickling filters. Compared to typical baseline effluent quality (prior to chemical addition) of BOD₅ = 20 mg/l, suspended solids = 15 mg/l, and total phosphorus = 8 mg/l, these same effluent parameters averaged 5 mg/l, 7 mg/l, and 0.5 mg/l, respectively, during the one-year extended alum run.

*For Grantee: City of Richardson
 P.O. Box 309, Richardson, Texas 75080

RESEARCH TASK / PROJECT TITLE Improved Trickling Filter-Based Treatment System			FY 1973 TASK NUMBER 21ABH 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Professor James C. Brown, UNC Wastewater Res. Center The University of North Carolina Chapel Hill, North Carolina 27514			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/6/69	EST. COMP. DATE 4/15/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$6,587 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this research project was to evaluate and demonstrate potential methods for upgrading the performance of high-rate trickling filter systems. Three major investigations were carried out using facilities of the joint University of North Carolina/City of Chapel Hill municipal treatment plant: (1) single-stage trickling filter operation was compared with two-stage trickling filter operation in pilot units with equivalent volumes in both systems; (2) overall system removal was analyzed in the full-scale plant as a function of final settling tank overflow rate; and (3) alum addition to the final clarifier was evaluated as an upgrading technique in the full-scale plant. Data from these investigations indicate: (1) in any treatment plant with two or more trickling filters, provisions for series or staged operation of the filters will produce significantly better treatment than operating the filters in parallel as single-stage units; (2) funds spent on additional final settling tank capacity is perhaps the most economical method of improving performance of trickling filter plants; and (3) controlled dosing of liquid alum just ahead of the final settling tank yielded the greatest improvement in treatment efficiency of all methods studied on this project, and can upgrade the performance of a high-rate trickling filter plant from marginal levels to one comparable with a well operated conventional activated sludge plant.

RESEARCH TASK/PROJECT TITLE Tertiary Solids Removal Following Combined Chemical-Trickling Filter Treatment			FY 1973 TASK NUMBER 21ABH 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR James C. Brown, School of Public Health University of North Carolina Chapel Hill, North Carolina 27514		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard C. Brenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 2/21/73	EST. COMP. DATE 6/21/74	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$60,000

TASK/PROJECT DESCRIPTION AND REPORTS

Two or more tertiary processes, including settling ponds and granular media filtration will be evaluated in depth for removing suspended solids (principally chemical floc particles) from aluminum sulfate (alum) coagulated and settled trickling filter plant effluent. The upstream trickling filter plant shall be a full-scale municipal high-rate system as typically operated in this country, with effluent (settled or unsettled) recirculation and a secondary clarified surface loading of 800 gpd/ft² or greater. Aluminum sulfate shall be continuously applied to the trickling filter effluent just prior to introduction to the secondary clarifier. Previous experience has established that the optimum alum dose is 200 mg/l $\pm$ 25 mg/l.

TREATABILITY OF ORGANIC COMPOUNDS

RESEARCH TASK/PROJECT TITLE Development of More Meaningful Molecular Indicators of Fecal Contamination of Fresh Water Resources			FY 1973 TASK NUMBER 21ABK 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Henry H. Tabak Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/1/70	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Intramural	FUNDING INFORMATION Federal Cost: \$12,500	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of the study were to develop more meaningful markers for domestic sewage contamination of water courses. Steroids offer such a class of organic compounds, since the sterol, coprostan-3 β -ol is one of the principal sterols in mammalian feces and its occurrence in water would indicate excreta from domestic waste or run-off from pastures and barnyards. The emphasis was to provide and outline an analytical method for the estimation of coprostanol in river water, sewage and treated wastewater and to quantitate the relationship between sterol and the extent and source of fecal pollution. An analytical procedure for the estimation of coprostanol in river water and wastewater was outlined and consisted of hexane extraction, mild alkali-alcohol hydrolysis of esters and conjugates to free the parent sterol, clean-up by thin layer chromatography, and quantitation by gas-liquid chromatography. The method was applied successfully to the recovery and quantitation of coprostanol from 57 different sampling points on the Missouri, Mississippi, North Platte, and Ohio Rivers. The study emphasized the merits of using this fecal sterol as a positive indicator of fecal pollution in addition to the standard for enumeration of fecal coliforms. A close correlation was shown between the concentration of coprostanol and the extent of fecal pollution of the water courses. Chlorination of raw wastewater and wastewater treatment plant effluents has no detectable effect on the structural configuration of coprostanol and it does not interfere with the assay. The method is very applicable for detecting domestic waste in industrial outfalls that are void of microorganisms because of heat and toxic substances. The research study was published in Industrial Microbiology, 13, 296-307, 1972.

RESEARCH TASK/PROJECT TITLE Biodegradability of Organic Compounds			FY 1973 TASK NUMBER 21ABK 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert L. Bunch Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/77	METHOD OF SUPPORT ☐ Contract ☒ Intramural	FUNDING INFORMATION Federal Cost: \$37,500	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to test the biodegradability of high impact organic compounds which are being discharged into municipal sewers. A list of organic compounds for which biodegradability potential is unknown, will be selected. Criteria used in the selection will include relative tonnage discharged nationally and toxicity considerations. Laboratory biodegradability techniques will be used to screen the selected compounds. Those which exhibit questionable biodegradability in the laboratory will be further evaluated in biological treatment pilot plants. Development of analytical methods to determine concentration in sewage will be necessary for some compounds. At the date of this writing, compounds for initial screening in FY '73 were in the process of being selected and analytical methods developed where necessary.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Treatability of Organic Compounds			21ABK 16/17
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Richard A. Dobbs Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$65,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine, through laboratory and pilot plant investigations, the capability of physical-chemical processes to remove potentially hazardous organic compounds from wastewater. Synthetic organic compounds are of particular concern because of toxicity, carcinogenicity, mutagenicity and teratogenicity. Laboratory evaluation of activated carbon will be based on adsorption isotherms. Standard jar test procedures will be used to determine the effect of chemical clarification on specific compounds. Pilot plant studies will be conducted by adding known compounds to wastewater. Specific analyses of the wastewater after each treatment process will be performed to measure the degree of removal achieved. Present plans involve the use of ultraviolet absorbance to measure concentrations of organics in laboratory tests with solvent extraction and gas chromatography employed for wastewater samples from the pilot plant.

PHYSICAL METHODS FOR DISINFECTION AND REMOVAL OF MICROORGANISMS IN WASTEWATER

RESEARCH TASK/PROJECT TITLE Bactericidal Effect of Various Combinations of Gamma Radiation and Chloramine on Aqueous Suspension of <u>Escherichia coli</u>			FY 1973 TASK NUMBER 21ABL 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Albert D. Venosa Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/69	EST. COMP. DATE 11/30/72	METHOD OF SUPPORT ☐ Contract ☒ Intramural ☐ Grant	FUNDING INFORMATION Federal Cost: \$35,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The primary objective of this project was to determine whether the bactericidal effectiveness of chlorine could be so enhanced by gamma radiation as to provide an economically feasible alternative to wastewater disinfection with chlorine alone. Different methods of combining gamma radiation with chloramine to disinfect aqueous suspension of E. coli were investigated. Logarithmically-grown cells were exposed to the bactericidal agents sequentially, (i.e., radiation followed by chloramine, and chloramine followed by radiation) and simultaneously. Regardless of which combination was used, the bactericidal effect was always less than additive. During the phase of work involving the simultaneous addition of both agents, it was observed that chloramine was destroyed more rapidly by radiation than were the organisms. Since an increase in the bactericidal effectiveness of either disinfectant by prior or simultaneous treatment of the cells with the other disinfectant was not achieved in buffered distilled water, it was concluded that disinfection of wastewater effluents by combining ionizing radiation with chloramine would not be economically feasible. Publication is in press and the final report is being prepared.

RESEARCH TASK/PROJECT TITLE Bacterial Zoogloea Formation			FY 1973 TASK NUMBER 21ABL 02(d)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard F. Unz, Asst. Prof. of San. Microbiology The Pennsylvania State University University Park, Pennsylvania 16802			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cecil W. Chambers Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 9/1/69	EST. COMP. DATE 2/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$13,132 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The study is aimed at the collection and evaluation of data related to the factors and mechanisms involved in bacterial zoogloea formation. Nine Zoogloea strains were examined for their ability to utilize 35 aromatic compounds. Benzoate, m--toluate, and p-toluate, as well as phenol, o-cresol, m-cresol, and p-cresol, were utilized by eight strains. These strains exhibited meta cleavage of catechol and of methyl-substituted catechols. With the exception of L-tyrosine, none of the aromatic compounds tested supported growth of Z. ramigera ATCC 19623. A medium containing sodium m-toluate was used to isolate 37 zoogloea-forming bacteria from various polluted environments. The isolates were identified as strains of Zoogloea.

CHEMICAL METHODS FOR DISINFECTION OF MICROORGANISMS IN WASTEWATER

RESEARCH TASK/PROJECT TITLE AWTRL Pilot Plant Studies on Disinfection			FY 1973 TASK NUMBER 21ABM 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Cecil W. Chambers Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/7/72	EST. COMP. DATE 9/30/75	METHOD OF SUPPORT ☐ Contract ☒ Intramural	FUNDING INFORMATION Federal Cost: \$65,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The only accepted standard method for enumerating coliform organisms in chlorinated wastewaters is the most probable number (MPN) procedure. Since the MPN procedure is only a statistical approximation subject to extreme variation, great care must be exercised in interpreting MPN data. Much controversy surrounds the use of the membrane filter (MF) procedure for chlorinated wastewaters. However, the data presently available precluding the use of the MF procedure for chlorinated wastewater is questionable. Therefore, it is the primary short-term objective of this study to compare the 5-tube MPN procedure with the MF procedure for enumeration of coliform organisms in chlorinated wastewater.

The long-term objective of this research involves chlorinating secondary effluent for disinfection purposes according to characteristic guidelines. It is hoped that by properly analyzing all the physical and chemical characteristics of wastewater passing through a sewage treatment plant, the dosage of chlorine necessary for adequate disinfection of the effluent may be predicted within reasonable limits. The parameters to be studied include suspended solids, chemical oxygen demand, suspended volatile solids, and ammonia nitrogen.

RESEARCH TASK/PROJECT TITLE Preliminary Evaluation of Chlorine Disinfection of Effluent from 3-Stage Activated Sludge			FY 1973 TASK NUMBER 21ABM 04 (a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Stephanie Roan, AWTRL, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE 1/1/73	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Intramural	FUNDING INFORMATION Federal Cost: \$2,500	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine the disinfection requirement for the effluent from the three-stage (BOD removal, nitrification, denitrification with alum or iron addition for phosphorus removal) activated sludge system at the EPA-DC Pilot Plant.

Effluent from denitrification will be chlorinated and filtered through dual or tri-media filters. Total counts will be determined on the influent and effluent from the filters with and without chlorination. The MPN will be determined on the final effluent.

RESEARCH TASK / PROJECT TITLE A Comparative Study of the Inactivation of Viruses in Wastewater by Chlorine and Chlorine Compounds			FY 1973 TASK NUMBER 21ABM 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Pasquale V. Scarpino, Prof. of Civil & Env. Engineering University of Cincinnati Cincinnati, Ohio 45221		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/1/72	EST. COMP. DATE 12/21/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$53,000

TASK / PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to determine the capability of chlorine and certain of its compounds to destroy viruses in wastewaters and in other waters. The chlorine and chlorine compounds that have been investigated are: (1) hypochlorous acid (HOCl); (2) hypochlorite ion (OCl⁻); and (3) the so-called combined chlorine compounds which comprise the ammonia chloramines and organic chloramines or N-chlor compounds. The following standardized virus stocks have been or will be used in these studies: (1) poliovirus 1; (2) coxsackievirus A9; (3) echovirus 7; (4) reovirus 1; and (5) an adenovirus. The rate of death of these selected test viruses, compared with appropriate reference organisms such as the bacterium *Escherichia coli* and selected coliphages, are being elucidated at different temperatures, contact times, and pH values. For example, comparisons were made between the inactivation rates at 50°C of viruses and bacteria in chlorinated phosphate buffer systems at pH 6 (HOCl), and in chlorinated borate buffer systems at pH 10 (OCl⁻). At pH 6, the animal viruses were the most resistant, being 13 times more resistant than the RNA coliphages, f2 and MS2 (which were equally sensitive), about 40 times more resistant than *E. coli*, and about 135 times more resistant than the DNA coliphage T5. At pH 10, *E. coli* was most resistant, being about twice as resistant as the animal viruses, about 8 times as resistant as T5, and 10 times as resistant as f2. The future use of coliforms and coliphages as indicators of animal virus pollution of water will be discussed and evaluated.

RESEARCH TASK / PROJECT TITLE The Detection and Inactivation of Enteric Viruses in Wastewater			FY 1973 TASK NUMBER 21ABM 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR H. I. Shuval, Head of Environ. Health Laboratory Hebrew University Jerusalem, Israel		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Berg Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 4/1/69	EST. COMP. DATE 3/31/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$131,878

TASK / PROJECT DESCRIPTION AND REPORTS

Carefully controlled and standardized laboratory experiments on the basic kinetics and chemistry of virus inactivation by ozone will be carried out in a cooperative study according to a research protocol developed by the Chief of Virology, National Environmental Research Center, Cincinnati. The studies will be carried out: (1) in demand-free aqueous solution; (2) in the presence of organic and inorganic pollutants; (3) in combination with chlorine and other disinfectants in various sequences and concentrations; (4) with continuous ozone dosing. The project will include basic studies of the chemistry of ozone and ozone species and their disinfectant characteristics in aqueous solutions and field studies to optimize, test, and evaluate ozonation under actual field conditions. A series of control comparative laboratory and field studies will be undertaken with the most promising methods available for detecting, quantitating, and identifying small amounts of viruses in large volumes of water. Further work on the development and evaluation of the phase-separation method, the pad method, and the fluorescent antibodies method will be carried out in laboratory and field studies.

RESEARCH TASK / PROJECT TITLE Parallel Ozonation and Chlorination with Dechlorination of Chlorinated Effluent			FY 1973 TASK NUMBER 21ABM 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR James Sheeran, City Engineer City of Wyoming, 1155 28th Street, S.W. Wyoming, Michigan 49509			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cecil W. Chambers Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/71	EST. COMP. DATE 10/31/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$261,308	

TASK / PROJECT DESCRIPTION AND REPORTS

The primary objective of this project is to disinfect parallel streams of effluent from a secondary activated sludge wastewater treatment plant with chlorine and ozone. Part of the chlorinated effluent stream will be dechlorinated with sulfur dioxide. The chlorinated, dechlorinated, and ozonated streams, and a control stream of the same effluent, would be compared for their toxic effect on several species of fish and macroinvertebrates. Disinfectant dosage will be controlled at levels sufficient to yield effluents having a total coliform count not to exceed 1,000 per 100 ml, but use of gross excesses of disinfectant beyond the amount necessary to yield the desired reduction in coliform content will be avoided. Results obtained will provide a basis for determining which system of treatment will combine the desired level of disinfection with the lowest toxic effect on the biological forms used in the tests. The same work will be carried out at a trickling filter plant that has industrial effluents equal to more than half its load. The project will commence after both plants have begun removing phosphates in compliance with the Lake Michigan Enforcement Conference orders. A fifth stream of final effluent disinfected with Bromine-chloride may be added at both plants.

RESEARCH TASK / PROJECT TITLE New Microbial Indicators of Wastewater Chlorination Efficiency			FY 1973 TASK NUMBER 21ABM 12	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. S. Engelbrecht, Professor of Environ. Engineering University of Illinois Urbana, Illinois 61801			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cecil W. Chambers Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/1/69	EST. COMP. DATE 6/30/76	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$21,100	

TASK / PROJECT DESCRIPTION AND REPORTS

This project has the following objectives: (1) through disinfection tests isolate from wastewater, microorganisms sufficiently resistant to chlorine that their destruction should assure an effluent free from enteric pathogens; (2) the chlorine resistance of isolates from "1" will be compared with that of coliform bacteria and virus pathogens; and (3) determine origin and improve the methods for recovering resistant indicator organisms.

This is a cooperative project with shared funding from both EPA and the U.S. Army Medical Research and Development Command.

DEVELOP PROCESSES FOR REMOVAL OF HEAVY METALS FROM WASTEWATERS

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Removal of Heavy Metals by Wastewater Treatment Processes			21ABO 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Harold Wolf, Water Reclamation Research Center 1020 Sargent Road Dallas, Texas 75216			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/28/72	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$118,166 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to determine heavy metal and virus removal by physical-chemical treatment of secondary effluent. Wastewater from Dallas trickling filter will be nitrified in pilot activated sludge unit (0.5 MGD) then passed through two tertiary treatment flow schemes in parallel. One flow sheet will provide only deep bed filtration in a multimedia filter. The other will provide chemical coagulation, flocculation, multimedia filtration, carbon adsorption and chlorination. Analysis for removals of 20 metals and virus at background levels will be conducted. Short runs with spiked inflow of f₂ phage and Type 1 polio will be made. Lime at pH >11 and alum will be used as coagulants.

Excellent phage removal (10⁵) and good metal removal have been achieved with high pH lime. Alum studies are not complete. Task 21ACP 07 provides in-house virus analytical work on this grant project.

*For Grantee: Dallas Water Utilities Department
500 S. Ervey, Suite 201A, Dallas, Texas 75201

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Analysis of Data and Preparation of Interim Report on Metals Removal			21ABO 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Sidney A. Hannah Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/3/72	6/30/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$5,000	

TASK / PROJECT DESCRIPTION AND REPORTS

Metals removal data from various sources are being collected and analyzed to provide guidelines for removal of specific metals and to serve as a basis for continuing in-house research on metals removal by physical-chemical treatment processes. For FY '74, this task has been incorporated into 21AST 14 and results will appear in the final report of that task.

RESEARCH TASK/PROJECT TITLE Process Modifications to Enhance Removals of Heavy Metals		FY1973 TASK NUMBER 21ABO 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Sidney A. Hannah Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 4/73	EST. COMP. DATE 12/75	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$12,500

TASK/PROJECT DESCRIPTION AND REPORTS

In a continuation of work started under Task 21ACP 09, removal of additional toxic metals by physical-chemical treatment processes will be determined. Unit processes will include coagulation with iron or lime, filtration and activated carbon adsorption.

Additional methods, such as chemical oxidation or reduction, chelation, precipitation and pH change will be used to enhance removals of those metals which are not effectively removed by normal treatment conditions. Initiation of this project awaits completion of the new physical-chemical pilot plants.

MUNICIPAL WASTEWATER SLUDGE HANDLING AND DISPOSAL

RESEARCH TASK/PROJECT TITLE Support for Contract, Grant, and Pilot Plant Studies Together with Service for Task Forces Related to These Studies			FY 1973 TASK NUMBER 21ACG 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Joseph B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$80,000 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to learn more about sludges and other waste streams produced by various processes. Conventional analytical measurements for various elements and colligative properties such as COD, heat of combustion, etc., will be determined. Specialized measurements of the physical properties of fresh sludges, such as specific filter resistance, settleability, etc., alone and when treated with appropriate polymers will be evaluated either in the field or in the Cincinnati Laboratory. In addition, a series of "Sludge Information Summaries" is being prepared from grant, contract, and pilot-plant investigations. If final reports of grants, contracts, and pilot-plant studies have already been prepared, these reports will be reviewed, and information on sludges will be extracted, evaluated, and published as a Sludge Information Summary. Contact will be made with project officers on projects not yet completed, to request them to see that sludge information is given proper emphasis in final reports on these projects.

Six "Sludge Information Summaries" have been prepared as internal documents. They can be obtained by contacting the project director. Additional summaries are in preparation.

RESEARCH TASK/PROJECT TITLE Sludge Handling Studies at Pomona			FY 1973 TASK NUMBER 21ACG 02(a)
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert B. Dean Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 7/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to determine sludge production rates, thickening characteristics, and dewaterability on the nitrification and physical-chemical treatment systems being evaluated at the Pomona Pilot Plant.

RESEARCH TASK / PROJECT TITLE Mercury and Other Heavy Metals in Sludge			FY 1973 TASK NUMBER 21ACG 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER B. Vincent Salotto Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/71	EST. COMP. DATE 3/31/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to determine what losses of mercury may occur as a result of addition of various forms of mercury compounds to sludge samples under controlled manipulative techniques. Analysis of total mercury by the cold digestion technique in spiked and unspiked sludge samples will be conducted under "rigidly" controlled laboratory conditions. A second objective is to characterize sludge as regards trace metals and other hazardous metals in sludge.

A paper is being prepared for publication.

RESEARCH TASK / PROJECT TITLE Preconcentration of Brines in Evaporation Cells as an Adjunct to Solar Evaporation Ponds			FY 1973 TASK NUMBER 21ACG 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John Muller, President Veracity Corporation, P. O. Box 717 Glen Echo, Maryland 20768		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/31/70	EST. COMP. DATE 3/31/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$43,000 (71)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project was to evaluate the feasibility of concentrating brines rejected from inland desalination plants by evaporation in a specially designed cooling tower. Performance of the cooling tower-evaporator was calculated for three representative sites in the United States, and costs compared with costs of other methods, such as evaporation ponds. Work on final report is nearly complete.

RESEARCH TASK/PROJECT TITLE Transfer of Sludge in a 2-inch Pipeline to a Strip Mine for Soil Renovation			FY 1973 TASK NUMBER 21ACG 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Timothy Shea Engineering Science, Inc., 4242 Airport Road Cincinnati, Ohio 45226		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 8/22/69	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$170,324 (70)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project was to complete the installation of the 1.5-inch diameter pipeline for transporting digested sludge from the Morgantown Wastewater Treatment Plant to a nearby strip mine; evaluate feasibility and economics of transport of sludges in small pipelines; determine by plant growth, experiments on the effectiveness of digested sludge for rejuvenating strip mines.

Experimental work has been completed. The final report is being prepared.

ORGANIC AND CHEMICAL SLUDGE THICKENING AND DEWATERING

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Wastewater Purification			21ACH 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR F. J. Micale, Center for Surface & Coatings Research Sinclair Laboratory, Lehigh University Bethlehem, Pennsylvania 18015			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Dean Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/69	3/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$120,909 (69)	

TASK/PROJECT DESCRIPTION AND REPORTS

The effect of various additives on the improved dewatering of activated sludge is being determined and the surface properties of the additives characterized in order to arrive at a mechanism for flocculation of activated sludge particles. The primary additives investigated are fly ash and 3 sludge incinerator ashes. All four ashes have high surface areas, 1.7 to 17 m²/g, a hydrophilic surface and a high concentration of water soluble salts. Since the presence of salts and a solid surface complicates the interpretation of experimental results, a series of experiments were devised where either salts or solids alone were added to the activated sludge for settleability measurements. The solids consist of the washed ashes themselves, as well as two silicas, two carbon samples and magnetite, which contains high surface areas and exhibits different surface properties. The salts consist of the washings obtained from the ashes and a number of inorganic salts and ionic polymeric surfactants. All four ashes greatly increase the rate of settling of activated sludge in the order Tahoe > Kansas > Millcreek > Beckjord. Repeated washing of the ashes has the effect of decreasing the rate of settling and changes the relative efficiency to Kansas > Millcreek > Beckjord > Tahoe. The hydrophilic silica carbon black and magnetite greatly increase the rate of settling while hydrophobic silica and graphon have very little effect. Halide salts and only the cationic polymeric surfactant are capable of increasing the rate settling. A dual mechanism, which was based on coulombic interaction between sludge particles and solid additives, is proposed. The final report is being reviewed.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Source Control of Water Treatment Waste Solids			21ACH 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Donald D. Adrian, Dept. of Civil Engineering University of Massachusetts Amherst, Massachusetts 01002			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James E. Smith, Jr. Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/69	6/1/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$60,177 (69)	

TASK/PROJECT DESCRIPTION AND REPORTS

This research is for the purpose of finding solutions to the sludge handling problem. Solutions are obtained by optimizing the design of sludge dewatering and drying beds. In order to optimize the design of these facilities additional research is carried out on the sludge dewatering process, the sludge drying process and the synthesis of dewatering and drying into economic designs. Included in the study are: A. Sludge dewatering - the role of chemical conditions; the role of additives; and the role of freezing. B. Sludge drying - the role of physical parameters; the effect of chemical conditioning agents and freezing upon drying. C. Synthesis of A and B into practicable designs - formulate models of each process; determine the costs associated with each process or operation; and optimize the design. A major accomplishment has been the development of computer programs for use in designing sand drying beds for the dewatering of water and sewage sludges. Computer input includes the characteristics of the sludge and physical environment.

RESEARCH TASK/PROJECT TITLE Evaluation of Existing Processes for the Dewatering of Physical-Chemical Sludges			FY 1973 TASK NUMBER 21ACH 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Joseph B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$137,500	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to: (1) determine and compare the dewaterability of a number of physical-chemical sludges by vacuum filtration, sand drying beds, pressure filtration, and centrifugation; (2) compare the dewaterability of these sludges with that of conventional sludges such as raw primary and waste activated; and (3) determine what inorganic or organic conditioners will optimize the dewatering of physical-chemical sludges by mechanical means and determine the overall cost of the systems.

This project will involve the collection of sludge from the appropriate physical-chemical system or systems if a comparative effort is in progress. The sludge will then be gravity thickened followed by a parallel dewatering project. Dewatering will be done by rotary vacuum filtration, centrifugation, and sand bed dewatering. A variety of chemical conditioners will be studied to assist in the optimization of the sludge handling schemes. Cost analyses will be made.

RESEARCH TASK/PROJECT TITLE Solids Handling of Physical-Chemical Sludges			FY 1973 TASK NUMBER 21ACH 04(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Stephen M. Bennett, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$40,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of the study are to develop thickening, dewatering and recalcination or incineration characteristics of physical-chemical sludges produced by lime treatment of raw wastewater at the EPA-DC Pilot Plant and to demonstrate recovery of lime by classification (centrifugation) and recalcination of the CaCO_3 in the sludges. The pilot scale thickening includes gravity and air flotation thickening. Dewatering studies include vacuum filtration (pilot and leaf tests), centrifugation for total capture and for classification, and pressure filtration for capture of the solids after thickening and in the centrate from the classification studies. The incineration or recalcination studies are performed in a multiple hearth furnace. Satisfactory classification (separation) of the CaCO_3 from the non-carbonate solids in the sludges from lime treatment of raw wastewater has been achieved. Recovery of lime with an available lime index of between 65 and 70% has been accomplished. The study is coordinated with the District of Columbia Grant (Task 21ACH 04(b)) to study solids handling and incineration in a fluid bed furnace.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Sludge Treatment Pilot Plant			21ACH 04(b)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alan B. Hais, Dept. of Environmental Services Government of the District of Columbia Washington, D.C.			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. NERC-Cincinnati, EPA, Washington, D.C.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/69	10/1/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$568,379 (70)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to design, construct and operate a solids handling pilot plant which when operated in coordination with the existing biological and physical chemical pilot plants at the District of Columbia Water Pollution Control Plant will provide complete evaluation at all treatment systems. The plant consists of gravity or air thickening, vacuum filtration, and fluid bed incineration. The solids handling studies are being performed on physical chemical (lime) sludges and biological (raw and waste activated) sludges from the oxygen activated sludge system, the three stage activated sludge system which includes mineral addition; and a single stage activated sludge system which provides simultaneously BOD removal, nitrification and denitrification. The data obtained includes thickening, characteristics, dewatering (vacuum filter and centrifuge) characteristics, chemical conditioning requirements and stack gas analysis studies for air pollution control.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Solids Handling and Chemical Recovery of Primary Lime Sludges			21ACH 04(c)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. B. Samworth, Dept. of Sanitary Engineering District of Columbia Washington, D.C. 20004			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. NERC-Cincinnati, EPA, Washington, D.C.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/71	4/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$72,800 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to obtain detailed data on the recovery of lime from lime sludges. Solids handling processes would be proposed for the design of new physical-chemical treatment facilities. Two basic approaches to the solids handling of lime sludges would be evaluated. This project would produce the following information: (1) thickening characteristics (of combined and separate sludges from the two lime stages); (2) centrifugation data on separation of CaCO_3 and inerts; (3) centrate handling data; (4) vacuum filtration characteristics and chemical conditioning data; (5) calcination data with and without inerts; (6) stack gas analysis to define any air pollution problems; and (7) design criteria for handling systems.

Research findings are reported at technical society meetings and are published in the literature. A project report will be released upon completion of the project.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Land Disposal of Raw and Waste Activated Sludge		21ACH 04(d)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alan B. Hais, Dept. of Environmental Services Government of the District of Columbia 415 12th St., N.W., Washington, D.C. 20004		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. NERC-Cincinnati, EPA, Washington, D.C.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
4/72	4/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$95,000 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are: (1) to determine the environmental effects (such as odors, nitrogen movement into ground water, and nitrogen phosphorus, and heavy metals uptake by plants) of land disposal (trenching) of various sludges (raw primary-activated, digested primary-activated, and mineral (alum) addition or lime treated sludges) in both greenhouse and field scale studies; and (2) to evaluate field scale trenching application techniques for limed raw and digested sludges at very high loadings per acre (over 200 tons/acre). Greenhouse studies in sandy soils simulated trenching techniques and revealed nitrogen and organic movement through four feet of soil. In the field studies, initiated in May 1972, raw and digested sludges were limed to pH 11.5 to stabilize the sludges, successfully placed in trenches (2' - 4' deep) and covered with backfill. Ground water samples were periodically withdrawn from field wells to determine movement of pollutants into the ground water; the area between trenches was planted with crops and trees. The results through November 1972 revealed essentially no movement of pollutants into the ground water and no odors or other esthetically objectionable effects and successful plant growth. The project is a cooperative study of the U.S. Department of Agriculture, the Maryland Environmental Services and the District of Columbia Department of Environmental Services.

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Fly Ash Filter Aid for Sewage Solids Dewatering and Disposal		21ACH 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR *J. W. Gerlich, Howard R. Green Company, Consultants 417 First Avenue, S.E. Cedar Rapids, Iowa 52401		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ralph Christensen, EPA, Region V 1 North Wacker Drive NERC-Cincinnati, EPA, Chicago, Ill. 60606	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
3/1/68	3/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$78,527 (68)

TASK/PROJECT DESCRIPTION AND REPORTS

The project will demonstrate the use of fly ash from a nearby power plant and sludge incinerator ash as filter aids in the pressure filtration of sludges. Pilot plant tests indicate that due to the nature of the sludge from the trickling filter plant, other alternate methods of pretreatment would incur severe economic penalties. On the other hand, the chemical ingredients in the fly ash and sludge incinerator ash, which are obtained at no cost, permit adequate dewatering at minimum cost. In addition, the trace minerals in the ashes and the plant food value from the sludge constitute a useable soil conditioner. The City of Cedar Rapids plans to utilize some of this sludge as a soil conditioner and fertilizer in their parks.

*For Grantee: City of Cedar Rapids
 Water Pollution Control Plant
 Cedar Rapids, Iowa 52401

RESEARCH TASK/PROJECT TITLE Top Feed Filtration			FY 1973 TASK NUMBER 21ACH 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Larry Ernest, Sewerage Commission of the City of Milwaukee, P.O. Box 2079 Milwaukee, Wisconsin 53201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 8/1/71	EST. COMP. DATE 2/10/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$261,258 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to modify an existing pilot-scale rotary vacuum filter from bottom feed to top feed mode. Evaluation will be made on effectiveness of the top-feed rotary vacuum filter for dewatering activated sludge when compared against existing bottom-feed filters. Determinations will be made for the top-feed filter, the filter cloth, and operating conditions which give best filtering rates and filtrate quality. Project is complete except for review of final report.

RESEARCH TASK/PROJECT TITLE Optimization and Design Criteria of an Oil Activated Sludge Concentration Process			FY 1973 TASK NUMBER 21ACH 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR T. M. Rosenblatt, Esso Research & Engineering Company Government Research Lab, P. O. Box 8 Linden, New Jersey 07036		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James E. Smith, Jr. Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/23/71	EST. COMP. DATE 3/5/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$80,420 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

Laboratory and pilot plant studies and cost calculations are being performed for a new process for the disposal of sewage sludge. The process consists of an oil assisted gravity separation of the majority of the water, followed by multiple effect evaporation to dryness in an oil slurry and incineration of the dry solids. In the gravity separation, secondary sludges are concentrated from about 0.5% up to 5-10% solids. Solids capture is $\geq 98\%$ with high shear oil-sludge contacting. However, solubilized organic carbon losses are observed in the separated water from the oil concentration and in the distillate from the evaporators. These losses are primarily temperature dependent and range up to about 25% of the secondary feed. The agreement of performance between laboratory and pilot plant results is good, indicating no scale-up problems. The process economics show an advantage of \$13-32 a ton compared to the best known commercial technology for a 189 ton/day plant processing a 50/50 mixture of primary + activated sludges to ash. The total costs for the process are estimated at \$21-39/ton of dry solids for the 189 ton/day plant. These cost estimates include an economic penalty for a 25% recycle of solubilized secondary sludge. A lower temperature gravity separation step could greatly reduce the total solubilization loss and could yield a net economic improvement of \$1-12/ton of dry solids, depending on plant size and sludge type. Other possible cost reductions in the thickening and settling steps have also been identified, which could amount to \$1-5/ton dry solids.

RESEARCH TASK / PROJECT TITLE Summary Report of Pilot Plant Studies on the Dewatering of Primary Digested Sludge			FY 1973 TASK NUMBER 21ACH 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John D. Parkhurst, Los Angeles Co. Sanitation Dist. 2020 Beverly Boulevard Los Angeles, California 90057		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Dean Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/6/72	EST. COMP. DATE 4/6/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$19,466

TASK / PROJECT DESCRIPTION AND REPORTS

LACSD is completing a \$500,000 study of sludge handling at their Harbor City plant. At the present time, about 50 percent of their sludge is captured in horizontal bowl Bird centrifuges, dried on the land, and sold for soil conditioner. They propose to prepare an engineering report on competitive dewatering processes they have studied, including a basket centrifuge, vacuum filter, pressure filter, air flotation tank, Porteous heat treatment unit, and multiple-hearth furnace. Pilot-scale examples of each piece of equipment have been installed and operated on their digested primary sludge. Funds will be used to complete engineering calculations and carry out additional engineering and analytical work to round out the study. LACSD has decided to use basket centrifuges to capture the solids in the centrate from their Bird centrifuges in order to meet new discharge requirements for suspended solids.

RESEARCH TASK / PROJECT TITLE Central Contra Costa County Combined Sludge Processing Project			FY 1973 TASK NUMBER 21ACH 11
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR *D. S. Parker, Brown and Caldwell 66 Mint Street San Francisco, California		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Dean Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/28/72	EST. COMP. DATE 3/15/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$15,000

TASK / PROJECT DESCRIPTION AND REPORTS

CCCSO has built an Advanced Treatment Test Facility (AATF) to treat raw sewage with lime followed by biological nitrification and denitrification at up to 2.5 MGD. The excess lime sludge is dewatered in a pair of centrifuges operated in series to separate calcium carbonate from calcium phosphate organic matter and inerts. Calcium carbonate is to be converted to recovered lime in one set of multiple hearth furnaces and the residual sludge will be incinerated in another set of furnaces. This proposal is to document the studies already carried out leading to the above conclusions and to fill in engineering and analytical data necessary to make a complete report. The State of California is co-sponsoring this report.

*For Grantee: Central Contra Costa Sanitary District
1250 Springbrook Road, Walnut Creek, California 94596

RESEARCH TASK/PROJECT TITLE Originating and Demonstrating Novel Methods of Sludge Dewatering			FY 1973 TASK NUMBER 21ACH 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. M. Chamberlin, Research & Development Center Westinghouse Electric Corp., Beulah Road Pittsburgh, Pennsylvania 15235		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James E. Smith, Jr. Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/28/71	EST. COMP. DATE 3/31/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$145,250 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The dewatering of biological sewage sludges by a proprietary capillary suction device on an endless belt is being studied. A compression roller increases the sludge dewatering and improves the cake discharge. The cake transfers to the compression roller and drops off onto a conveyor. The capillary belt (porous felt) is then washed and dewatered with additional compression rollers. Results for waste activated sludge have been extremely encouraging. The operation of the device requires little or no chemical conditioning which could mean a significant saving over other filtration systems. Solid yields well in excess of 2.5 and as high as 6.0 lbs/ft², hr., have been obtained with polyurethane foam and polypropylene and nylon felts. Life tests of polypropylene felt and polyurethane foam media have been in progress for over 17 months. Dry solids off the compression roller exceeded 16 percent in general, and have been as high as 21 percent. A 1,000 gpd capillary dewatering unit is presently being demonstrated at a Pittsburgh sewage treatment plant.

RESEARCH TASK/PROJECT TITLE Demonstration of a Device for Improved Gravity Thickening of Wastewater Sludges			FY 1973 TASK NUMBER 21ACH 14
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Stanley R. Rich, R.P. Industries, Inc. 344 Boston Post Road Marlboro, Massachusetts 01752		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James E. Smith, Jr. Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 8/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$75,931 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this work is to optimize the "Seprameg" Process for dewatering waste activated sludge. In this process non-magnetic suspended solids are rendered temporarily magnetic by the addition of small quantities of inert and non-toxic magnetic materials combined with small percentages of certain binding agents. A magnetic separator should then readily separate out all of the suspended solids. According to preliminary work results, the separated solids are thickened and dewatered at the same time resulting in the production of a sludge of high solids concentration. Pre-contract work by R. P. Industries on a "test tube" scale, indicated that a 4 percent solids waste activated sludge with 0.2 percent magnetic material, added together with 0.5 ppm of binding material, could be dewatered in 3 seconds to approximately 30 percent solids.

Since commencement of work on this project, R.P. has found that a continuous unit is unable to dewater sludge above about 8 percent net sludge solids. Consideration is being given to changing the scope of work to a more fruitful area.

STABILIZATION OF MUNICIPAL WASTEWATER TREATMENT PLANT SLUDGE

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Waste Heat Utilization in Wastewater Treatment			21ACI 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Mel Fields, URS Research Corporation 155 Bovet Road San Mateo, California 94402			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/70	5/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$34,530 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine the technical and economic feasibility of using waste heat to improve conventional and advanced wastewater treatment processes, with emphasis for low temperature areas. The approach is to conduct a "desk top" study for the determination. Cost benefit analysis indicates that where secondary effluent treatment is employed and capacity is greater than 5 MGD, the benefits exceed costs from 0.2 to 0.9¢/1000 gallons provided the transport of waste heat is less than one mile. Fouling of heat transfer is an unknown factor. For advanced waste treatment processes, the use of waste heat shows a cost benefit ranging from 1.6¢ to 9.4¢/1000 gallons for the reverse osmosis, carbon adsorption and ion exchange processes. Use of waste heat to increase temperatures during nitrification would have the effect of decreasing the required aeration volume, hydraulic detention time and oxygen requirement, in addition to carbonaceous oxidation. The group utility concept (wastewater treatment plant near an electric power utility) could result in savings ranging from 1¢ to 45¢/1000 gallons. A final report is in preparation.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Experimental Investigation of the Aerobic Stabilization of Sludges from Wastewater Treatment			21ACI 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John L. Puntenney, Metropolitan Denver Sewage Disposal District No. 1, 3100 E. 60th Avenue Commerce City, Colorado 80022			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James E. Smith, Jr. Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/72	6/30/74	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$81,798 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The information obtained from this research will provide information on the aerobic stabilization process. Variables to be investigated include: (1) the time of stabilization; (2) the process loading; (3) the amount of air or oxygen applied; and (4) the percent of primary and secondary sludge that is mixed together so that a variety of conditions might be studied. Important considerations will be maintenance requirements and the ultimate method of disposal for the stabilized sludge. Consideration will be given to batch, continuous, one, two-stage, and multi-stage operation. This work comprises plant and pilot scale studies. In the plant scale study, emphasis will be on the effect of load variation, while in the pilot study, emphasis will be on the effects of varying the solids concentration under aeration, detention time, dissolved oxygen level, loading, and mixture of primary and waste activated sludges. Both studies will consider the thickening and dewatering properties of the non-stabilized and stabilized sludges. In addition, the pilot study will consider batch, continuous, and staged operation.

RESEARCH TASK/PROJECT TITLE Design, Development, and Evaluation of a Lime-Stabilization System to Prepare Municipal Sewage Sludge for Land Disposal			FY 1973 TASK NUMBER 21ACI 11
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR A. J. Shuckrow, Battelle Memorial Institute Pacific NW Laboratories, P.O. Box 999 Richland, Washington 99352		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James E. Smith, Jr. Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 11/1/72	EST. COMP. DATE 3/31/74	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$84,800

TASK/PROJECT DESCRIPTION AND REPORTS

This program is designed to determine operational parameters for a process to produce lime-stabilized sewage sludge suitable for land disposal. Lime dosages and contact times required to stabilize raw sewage sludges from a pathological and odor standpoint will be determined by preliminary laboratory studies, and the information obtained will be translated into operational parameters for a pilot scale, continuous flow process. Physical, chemical, and biological characteristics of the stabilized sludge produced by pilot plant operation will be determined on a continuing basis. Soil and crop studies, both in a greenhouse and on controlled outdoor plots, will be performed to determine the long-term effects of spreading lime-stabilized sludge on soil.

RESEARCH TASK/PROJECT TITLE Heat Treatment of Sludge by Porteous Process			FY 1973 TASK NUMBER 21ACI 22
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert J. Alban, Office of Lake Co. San. Engineer H. T. Nolan Building Painesville, Ohio		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/15/69	EST. COMP. DATE 12/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$645,907 (69)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to perform heat treatment on wastewater sludges from Lake County's Mentor and Madison plants, as well as sludge from other selected locations. The effect of the temperature and time of heat treatment on the dewaterability of the sludges and on the quality of the supernatant and filtrate removed from the sludge will be determined.

LAND APPLICATION OF SLUDGES

RESEARCH TASK/PROJECT TITLE Agricultural Benefits & Environmental Changes Resulting from the Use of Digested Sludge on Field Crops & Criteria for Use in Selecting Disposal Sites			FY 1973 TASK NUMBER 21ACJ 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Cecil Lue-Hing, Metro. San. Dist. of Greater Chicago 100 East Erie Street Chicago, Illinois 60611			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/67	EST. COMP. DATE 6/30/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$211,380 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The beneficial effects on crops and soils of applying nutrients, organic matter, and water in digested sewage sludge are being demonstrated. Field plots and recording lysimeter plots were used to measure the long range effects of the metals, other organic and inorganic constituents upon the runoff and drainage water, soil properties, and crop yields and composition. Three contrasting soil types are used in the lysimeter plots. Criteria for selecting sites and designing a land disposal system for large municipalities are being developed. The project is in the fifth year.

RESEARCH TASK/PROJECT TITLE Treatment of Wastes Using Peat, and Peat in Combination with Soil			FY 1973 TASK NUMBER 21ACJ 01(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert Scuffy, Dept. of Iron Range Resources & Rehab. State of Minnesota St. Paul, Minnesota 55101			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 4/1/69	EST. COMP. DATE 3/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$44,380 (69)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective was to determine the effectiveness of various kinds of peat and peat-soil mixtures as filter media in treating sewage. Application techniques, the mechanism of BOD and phosphorus removal from the sewage and regeneration of the adsorptive capacity of the peat were studied. Drained plots in a natural peat bog, lysimeters, and columns in the laboratory were used in the study. Thin layers of peat over sand were found to be effective in removal of BOD and phosphorus from sewage. The draft of the final report has been prepared.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Land Reclamation Through the Use of Digested Sewage Sludge			21ACJ 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Ben Sosewitz, General Superintendent Metro. San. Dist. of Greater Chicago, 100 E. Erie Street Chicago, Illinois 60611			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/69	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$610,500 (69)	

TASK/PROJECT DESCRIPTION AND REPORTS

A 100-acre burned dump adjacent to the Calumet Sewage Treatment Plant was used to demonstrate benefits of applying liquid digested sewage sludge to improve marginal land for crop production. Sludge was applied in sufficient quantity to build up the organic matter and fertility before wheat and corn were grown. The effects of sludge on the soil and crops were measured. A draft of the final report has been prepared.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Review of Landspreading of Liquid Sewage Sludge			21ACJ 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR J. M. Genco, Battelle Memorial Institute 505 King Avenue Columbus, Ohio 43201			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/72	6/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$51,755 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this program is to provide a critical review of existing information and operational experiences in landspreading of liquid sewage sludge. Major emphasis will be given to obtaining information concerning unreported landspreading operations currently employed in this country, through a telephone survey and visits to representative treatment plants and associated landspreading operations. This information will be evaluated with respect to present technology, and environmental impacts from landspreading including evaluation of landspreading subsystems relating to sludge handling and conditioning, modes of transport, spreading techniques, and soil and/or crop responses. Further, this program will also provide a summarization and an updating of sewage sludge landspreading practices found in the literature. An evaluation of the data obtained will identify deficiencies where additional studies are needed and aid in the development of proper design criteria for landspreading systems.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Treatment Processes - Wastes Pumped from Septic Tanks			21ACJ 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR John J. Kolega University of Connecticut Storrs, Connecticut 06268		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/69	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$230,441 (69)	
TASK/PROJECT DESCRIPTION AND REPORTS				

A three-year study of the characterization, volumes, appropriate treatment and handling methods of septic tank sludge was conducted. Public attitudes and policies toward septic tank sludge treatment and disposal were determined by interviews and questionnaires. Pilot studies of treatment and disposal by soil injection, aeration-anaerobic digestion-filtration system, and controlled addition to a small municipal sewage treatment plant were conducted. A draft of the final report has been written.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Wastewater Solids Utilization on the Land			21ACJ 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Michael Gritzak, Ocean County Sewerage Authority 40 Hadley Avenue Toms River, New Jersey 08753		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/72	6/75	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$200,000 (72)	
TASK/PROJECT DESCRIPTION AND REPORTS				

The applicant proposes to demonstrate the feasibility of disposing of sewage sludge by applying it to soils that are typical of many found along the East Coast. Improvement of low quality land without detrimental environmental impact will be demonstrated. Application techniques and rates compatible with the environment and the constraints imposed by sludge properties, will be determined. Extensive ground water quality studies are to precede the sludge application and are to be run during sludge spreading.

RESEARCH TASK/PROJECT TITLE Evaluation of Use of Physical-Chemical Sludges on Land			FY 1973 TASK NUMBER 21ACJ 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/71	EST. COMP. DATE 6/30/74	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$55,000 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

Greenhouse pot culture is being used to determine the effects of applying physical-chemical sludge on soils. Aluminum hydroxide and ferric chloride are added to sewage to precipitate phosphate. Sludge is limed to pH 11.3 to stabilize it. The effect of the sludge on soil, crops, and leachates is being measured.

RESEARCH TASK/PROJECT TITLE Availability, Performance Characteristics, Cost & Functional Designs of Equipment and Machinery for Disposal of Sludges & Other Organic Wastes on Soils			FY 1973 TASK NUMBER 21ACJ 15
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR G. L. Nelson, Agricultural Engineering Professor Ohio Agricultural Research & Development Center Wooster, Ohio		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 2/1/70	EST. COMP. DATE 3/1/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$22,179 (70)

TASK/PROJECT DESCRIPTION AND REPORTS

A 12-month study of available equipment and systems for spreading wastes on land was conducted. Interviews, questionnaires, and demonstrations were sources of information. A method of sludge disposal systems analysis was developed. The draft of the final report has been prepared.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Microbiology of Sewage Sludge Disposal in Soil		21ACJ 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert Miller, Professor of Agronomy Ohio State University Wooster, Ohio		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER G. Kenneth Dotson Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
2/16/70	8/15/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$56,289 (70)

TASK / PROJECT DESCRIPTION AND REPORTS

A laboratory and growth chamber study of climate, soil, and sludge factors that determine the rate of microbiological decomposition of organic matter in sludge treated soils was conducted. Microbial populations and activity were identified and studied. The effects on 40 and 100 tons of freeze dried digested sludge solids per acre applications on growing plants was determined. Specific soil and climatic factors that determine the rate sludge decomposition are being ascertained by multiple regression equations. Phytotoxic substances in leachates were analyzed. More efficient management and better site selection will be possible because of the project. The final report is being prepared.

TREATMENT OF SUPERNATANT FROM SLUDGE CONDITIONING

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Conditioning of Wastewater Sludges Using SO ₂ and Low Pressure Steam			21ACK 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Myron Weinberg, Foster D. Snell, Inc. Hanover Road Florham Park, New Jersey 07932			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert B. Dean Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/3/69	3/31/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$122,125 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

Pressure cooking of sludge to improve filterability, as by the Porteous or Zimpro process, requires high temperatures and pressures (about 185°C and 400 psig). The addition of SO₂ reduces the temperature to about 125°C. The supernatant liquor can be evaporated to an organic molasses that is rich in amino acids and sugars. Further evaporation produces an Organic Feed Concentrate (OFC) that has potential as an animal feed supplement. No adverse metabolic or teratogenic effects from OFC in the diet of rats or chickens, have been found at low dosages. The high phosphoric acid content of the first batch of OFC led to difficulties with egg production which can easily be corrected by an intermediate lime clarification. Further studies will have to be carried on at a scale sufficiently large to produce useful quantities of improved OFC for larger scale feeding tests.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Treatment of Supernatants from Heat Treatment of Sludge			21ACK 01(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert B. Dean Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/72	7/1/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$17,500	

TASK/PROJECT DESCRIPTION AND REPORTS

Heat treatment supernatants and filtrates are high in BOD and COD and place a large load on wastewater treatment plants.

The objective of this study is to evaluate the magnitude of the effect of recycle of these liquors on the final wastewater effluent, and to develop means for treating them to minimize their impact on effluent quality.

BY-PRODUCT RECOVERY FROM SLUDGE

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Studies on the Methanogenic Bacteria in Sludge		21ACL 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Paul H. Smith, Professor of Microbiology University of Florida Gainesville, Florida 32601		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Cecil W. Chambers Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
5/22/69	9/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$28,331 (70)

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to isolate the methanogenic bacteria present in digesting domestic sewage sludge and to determine those factors which control the rates of anaerobic digestion. Emphasis is being placed on methane production from intermediates in the digestion process. Hydrogen gas, acetate, propionate and butyrate are being investigated. Isolation attempts are being made utilizing methods which give maximum control of oxygen tension. O/R potential is being maintained below 300 mv. Intermediates and rates are being investigated using isotope dilution techniques.

The hydrogen utilizing methanogenic microflora has been isolated and its ecological function has been demonstrated. Hydrogen has been shown to inhibit short chain fatty acid metabolisms. The hydrogen utilizing microflora maintains the hydrogen concentration below a toxic level. Current studies involve efforts to develop a methane fermentation which is insensitive to environmental changes. This is being approached by selection of insensitive mixed populations of organisms capable of dissimilating organic water.

HANDLING AND DISPOSAL OF WATER TREATMENT PLANT SLUDGES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Disposal of Waterworks Sludges at Sewage Treatment Plants			21ACN 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER B. Vincent Salotto Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
5/1/72	6/30/72	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$7,500 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to determine by a pilot plant study, the effects doses of waterworks sludge has on activated sludge process in terms of treatment efficiency; determine by sampling sewage outlets phosphate-removing ability of several doses of waterworks sludge, added singly, in activated sludge process; and determine the effects of addition of waterworks sludge on the efficiency of operation in terms of COD and SS removals and turbidity of final effluent. A report of the research results has been published. An oral presentation was made at the 34th Annual American Water Works Association (Ohio Section) Meeting in Cincinnati, Ohio, October 25 - 27, 1972.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Treatment of Waste Alum Sludge from a Water Treatment Plant			21ACN 50	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR *Patrick F. Mahoney, Smith & Mahoney Consulting Engineers 11 North Pearl Street Albany, New York 12207			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph B. Farrell Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/27/71	3/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$31,871 (71)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to conduct a detailed pilot plant alum sludge filtration study at the Feura Bush Water Treatment Plant of the City of Albany. The objectives being to optimize operating parameters, demonstrate process reproducibility, and develop information necessary for full-scale plant design. Rotary vacuum precoat filtration of alum sludge will be conducted and technical and economic feasibility will be determined. A comparison of the performance of various filter aid grades and other operating variables, and cost effectiveness of the sludge treatment, will be made. Design criteria for a full-scale facility will be sought. The dewatering of alum sludge by natural freezing followed by thawing will be followed in a pilot scale study. Economics will be compared with cost of precoat filtration. Project is complete except for final report.

*For Grantee: City of Albany, Dept. of Water and Water Supply
City Hall, Albany, New York 12207

WASTEWATER RENOVATION AND REUSE FOR POTABLE WATER SUPPLY

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Demonstration of Virus Removal from Municipal Sewage			21ACP 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Hugh C. Norris, Jr., Department of Public Works City Hall, Military Plaza San Antonio, Texas 78205			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
8/1/69	12/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$423,750 (70)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to demonstrate the suitability of lime coagulation for removal of virus from municipal sewage and to prevent the creation of an imminent public health hazard from the rapid, natural percolation of sewage treatment plant effluents containing active viruses into the out-cropping limestone aquifer used by the City of San Antonio as its water supply and to demonstrate that use of this process as the primary treatment step can provide additional benefits of considerable economic value.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Part 1. Quantitation of Pathogens in Effluent and Affected Areas Part 2. Fate of Microorganisms in Advanced Waste Treatment			21ACP 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Bernard A. Kenner Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/70	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$50,000	

TASK / PROJECT DESCRIPTION AND REPORTS

Part 1: The objective is to develop simplified quantitative methods requiring no special facilities and no special equipment for isolating and enumerating classes of bacterial pathogens known to be present in municipal and industrial wastes, as well as in miscellaneous pollution sources, such as agricultural. These methods are to be distributed to all Federal Agencies and interested parties. Methods have been completed and published in-house for the simultaneous quantitation of Salmonella species and Pseudomonas aeruginosa from treatment effluents and affected areas. The methodology paper has also been cleared for publication in a journal. Currently, work has commenced in efforts to develop methods for the isolation and enumeration of pathogenic species of Leptospira from polluted waters and treatment effluents, and also concurrently, work has been started on the isolation of Shigella species. There are no precedent methods for the isolation of the latter two groups of pathogens from water. Service samplings from other research projects in wastewater treatment are utilized at no additional cost other than chemical or serological materials. Part 2: The objective is to make evaluations throughout successive stages of advanced waste treatment processes (from influent to effluent) of the progressive elimination of both pathogenic and indicator bacteria. This will relate the fate of such microorganisms to specific types of bacterial nutrients and growth promoters. Information should indicate which advanced waste treatment processes can most effectively produce water for specific reuse needs. This is a service research project for other research programs as requested, and requires a bacteriologist interested in taxonomy, as is the requester. Results have been published by research programs requesting the service.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Removal of Heavy Metals by Wastewater Treatment Processes			21ACP 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
2/28/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$35,000

TASK / PROJECT DESCRIPTION AND REPORTS

This task provides in-house virus analytical work for Task 21ABO 02 grant project described below. The objective is to determine heavy metal and virus removal by physical-chemical treatment of secondary effluent. Wastewater from Dallas trickling filter will be nitrified in pilot activated sludge unit (0.5 MGD) then passed through two tertiary treatment flow schemes in parallel. One flow sheet will provide only deep bed filtration in a multimedia filter. The other will provide chemical coagulation, flocculation, multimedia filtration, carbon adsorption and chlorination. Analysis for removals of 20 metals and virus at background levels will be conducted. Short runs with spiked inflow of f2 phage and Type 1 polio will be made. Lime at pH >11 and alum will be used as coagulants. Excellent phage removal (10⁵) and good metal removal have been achieved with high pH lime. Alum studies are not complete.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Special Studies on Water Reuse			21ACP 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Stephanie Roan, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. NERC-Cincinnati, EPA, Washington, D.C.	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$35,000

TASK / PROJECT DESCRIPTION AND REPORTS

The study, in cooperation with NERC's virology group, is determining the effectiveness of various pilot plant systems, especially the three stage activated sludge (staged nitrification-denitrification) system for removing virus and heavy metals. The feed waters and intermediate effluents in the systems are also being "spiked" with virus or heavy metals to improve the evaluation of individual process and system removal efficiencies. The heavy metals concentrations are determined by atomic adsorption techniques. The virus analyses are performed by NERC's virology section.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER
Removal of Toxic Metals in Physical-Chemical Pilot Plant			21ACP 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Sidney A. Hannah Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
1/72	2/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$20,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to determine removals of toxic metals, such as Cd, Hg, Cr, Zn, Pb, Ba, Ni, Mn, and As by coagulation with iron and by precipitation with low and high lime dosages; and determine the effectiveness of activated carbon for metals removal.

Influent to the pilot plant was analyzed for the metal of interest and spiked to 5 mg/l with additional metal. Removals after chemical addition and sedimentation, filtration and carbon adsorption were determined. Experimental work on the above metals is complete. In general, good removals were obtained. A report on the work is in preparation.

WASTEWATER RENOVATION AND REUSE FOR NON-POTABLE REUSE

RESEARCH TASK / PROJECT TITLE Advanced Waste Treatment for Water Reclamation and Reuse by Injection			FY 1973 TASK NUMBER 21ACQ 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Herbert J. Simons, Commissioner of Public Works County of Nassau Mineola, New York 11501			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/31/66	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$700,000 (67)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to conduct studies of advanced waste treatment processes and to demonstrate that the reclaimed secondary effluent is suitable for reuse and injection into underground aquifers. This project will provide operating data on advanced waste treatment processes and allow optimizing the economics of the process. It will also demonstrate the effectiveness and reliability of advanced waste treatment as a method of providing water for reuse from secondary treatment plant effluent.

RESEARCH TASK / PROJECT TITLE Tertiary Treatment by Lime Addition at Santee, California			FY 1973 TASK NUMBER 21ACQ 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Edwin Houser, Santee County Water District P. O. Box 70 Santee, California 92071			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 12/66	EST. COMP. DATE 5/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$800,000 (67)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to demonstrate on full scale, that lime tertiary treatment followed by dual media filtration can provide effective treatment for reclaiming secondary effluent and that these processes can be used as substitute for the Santee percolation beds for producing recreational lake water. A nominal 2 MGD tertiary facility - lime addition - one stage lime treatment (with and without polymers) in a solids contact reactor-clarifier; pH adjustment with CO₂ produced from natural gas and dual media filtration. The facility was built and operated for 22 months. Secondary effluent was compared to tertiary effluent, and also to additional treatment by carbon adsorption and electrodialysis, as well as from percolation beds treatment for algal growth in the laboratory and in simulated ponds. The final report is scheduled to be completed by May 1973. It was demonstrated that a small sanitary district can build a tertiary treatment plant through regular consulting engineering design and bidding procedures, and operate the facility with regular plant personnel. Phosphorus removal in solids contact reactor-clarifier was 85% with a lime (CaO) dosage of 60 mg/l and a pH range of 9.5 to 10.0. Phosphorus removal can be increased to 95% (0.77 mg/l P as residual) with a lime dosage of 200 mg/l and pH range of 10.5 to 11.0. Approximately 0.75 gpm/ft² was found to be a reasonable operating upper limit flow rate for the solids contact reactor-clarifier. Equipment reliability was a serious problem in this small plant. Using Santee secondary effluent as a basis, the lime treatment resulted in a 10-fold reduction, and the addition of granular activated carbon and electrodialysis treatment resulted in a 100-fold reduction in algal growth. The estimated cost for a 1.5 MGD steady flow, with a 200 mg/l lime dosage and filtration, is 19¢/1000 gallons.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Water Reclamation Project for Antelope Valley			21ACQ 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard E. Kuhns, Sanitation Division Engineer County of Los Angeles, Dept. of County Engineer 108 W. 2nd St., Los Angeles, California 90012		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER John N. English Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/70	12/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$90,000 (71)

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to enable engineers and scientists to conduct continuing studies under actual "full-scale" operational conditions of a wastewater reclamation project in Antelope Valley; to demonstrate that sufficient algae and nutrient removal can be realized to prevent excess biological growth, and to maintain aesthetic levels of clarity, and to assure an adequate habitat for fish life in recreational lakes; to ensure safe degree of enteric pathogen and virus destruction to permit safe use of reclaimed wastewater; to provide controls for any insect or noxious plant problems which occur in conjunction with such projects; to develop a "Manual of Practices" that would have widespread application in the field of wastewater reclamation; and to demonstrate the acceptability by the public of the use of reclaimed wastewater for establishing attractive aquatic recreational facilities, especially in water-short desert areas.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Demonstrated Technology and Research Needs for Reuse of Municipal Wastewater			21ACQ 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Curtis J. Schmidt, Vice President S.C.S. Engineers, 4014 Long Beach Boulevard Long Beach, California 90807		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Irwin J. Kugelman Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/14/72	9/18/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$56,775 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to conduct a state-of-the-art survey of intentional reuse of municipal wastewater. All pertinent domestic and foreign literature will be searched. Specially designed survey forms will be mailed to all known reuse installations, and all U.S. Federal, state, and municipal agencies. The data will be processed to determine: (1) quality standards for types of reuse application; (2) economics of available technology for production of usable water from municipal sewage; (3) research needs; and (4) market projections.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Reverse Osmosis of Treated and Untreated Secondary Sewage Effluent			21ACQ 50	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Doyle Boen, Eastern Municipal Water District P.O. Box 858, 24500 San Jacinto Street Hemet, California 92343			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
1/67	5/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$37,466 (67)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to demonstrate on a pilot scale, the effectiveness of reverse osmosis to remove constituents, particularly dissolved solids, from secondary effluent (activated sludge). Pretreatment of the reverse osmosis feed is needed to enhance effectiveness. A facility was constructed to develop the most feasible combination for post-treating secondary effluent as feed to the reverse osmosis process. Six reverse osmosis units from 5,000 to 10,000 gpd nominal capacity, having different module designs and membrane flux characteristics, were tested over a 15-month operating period. Alum coagulation followed by sand filtration or sand filtration followed by activated carbon, were equally effective for treating secondary effluent prior to reverse osmosis. Adding small amounts of chlorine, and pH adjustment to around 5 of the feed water, were needed for partial sterilization and scale deposition control. The most effective reverse osmosis module and product water flux membranes was the tubular configuration with a relatively tight membrane (low product water flux--high salt rejection). Membrane fouling was encountered even with the use of all of the secondary effluent post-treatment processes in series. Various methods, such as acid flushes, enzymatic-detergent combination treatment, EDTA, sodium borate, air-water flushing were tried for removing membrane foulants. EDTA was found to be effective for inorganic fouling (scale deposition) removal. Enzymatic-detergent and sodium borate were effective for organic or organic combined with particulate (colloidal or suspended solid) fouling. Membrane fouling effects can be controlled by periodic treatment. Total estimated costs, including secondary effluent post-treatment and assumed 3-year membrane life, are 76.5¢/1,000 gal for a 1 MGD facility, and 64¢/1000 gal for a 10 MGD facility. The final report is being prepared.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Carbon Adsorption and Electrodialysis for Demineralization at Santee, California			21ACQ 51	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Edwin Houser, Santee County Water District P. O. Box 70 Santee, California 92071			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
10/68	5/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$37,522 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives are to demonstrate activated carbon treatment followed by electrodialysis of tertiary effluent to produce a final water product equal to or exceeding the quality of Santee raw water (Colorado River water); to compare the product water with PHS Drinking Water Standards; and to compare the electrodialysis process with De-Sal ion exchange process for demineralization. A 100,000gpd activated carbon, followed by a 50,000 gpd, 2-stage, electrodialysis process facility, was constructed and operated for one year on tertiary (lime treated and dual media filtered) effluent. The final report is in preparation. Darco activated carbon was used for organic removal. COD removal in 3-stages (approximately 36 minutes detention at 2 gpm per square foot application) was 60%. Carbon fines, after thermal regeneration was a serious problem. The electrodialysis process produced an effluent with a quality exceeding Santee Colorado River raw water supply and very nearly equal to PHS Drinking Water Standards. Activated carbon treatment cost for 100,000 gpd capacity and replacement of the carbon is estimated at 32¢/1000 gallons. The estimated cost for a 50,000 gpd electrodialysis treatment is \$1.04/1000 gallons.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Tertiary Sewage Treatment for Reclamation and Full Reuse			21ACQ
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Roy Stoyer, Director, Adv. Planning & Development Irvine Ranch Water Dist., P.O. Box D-1 4201 Campus Drive, Irvine, California 92264		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gerald Stern Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	FST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
1/67	7/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$325,500 (67)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to demonstrate nutrient removal for reclamation of wastewater. A 0.26 MGD (pilot scale) nutrient removal wastewater treatment facility was constructed and operated for 12 months. The major steps involved were: (1) phosphate incorporation into biological sludge and nitrification in an aeration basin; (2) sludge-liquid separation by either vibrating screens and/or dissolved air flotation; (3) the liquid phase is treated for nitrogen removal (denitrification) in an upflow sand filter with methanol addition as organic food source; (4) the concentrated sludge (2% to 3%) from the vibration screens and/or dissolved air flotation is treated with acid (sulfuric) to reduce the pH to around 5 (at this pH the phosphate in the sludge is solubilized); and (5) the phosphate laden liquid phase is separated from the solid (sludge) phase by co-current solid bowl centrifugation. The phosphate-free sludge is recycled to the aeration basin. Thus mechanical separation is used to separate the liquid and concentrate the sludges as quickly as feasible to avoid biological sludge deterioration. Dissolved air flotation is a very effective process for separating mixed liquor. The flotage (sludge) solid phase) can be concentrated to 3% solids. Up-flow sand filtration provides an excellent media, with methanol addition, for denitrification. Care must be taken to avoid solids breakthrough by nitrogen gas bubbles. The combination of nitrification in the aeration basin, dissolved air flotation for solids-liquid separation, and adding methanol as organic food source to the liquid influent feed to the upflow sand filter, results in up to 95% nitrogen removal. Vibrating screens are not an effective separating device for mixed liquors. Phosphate removal could not be demonstrated because of the ineffectiveness of the co-current solid bowl centrifuge to separate the phosphate laden liquid from sludge. A final report is being prepared.

OPTIMIZATION OF WASTEWATER TREATMENT PROCESSES, TREATMENT
TRAINS AND SEWERAGE SYSTEMS

RESEARCH TASK / PROJECT TITLE Cost and Sizing Relationships for Wastewater Treatment Processes			FY 1973 TASK NUMBER 21ACT 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Smith Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$12,500	

TASK / PROJECT DESCRIPTION AND REPORTS

This is a continuing intramural project to develop cost and sizing relationships for conventional and advanced treatment processes for municipal wastewater. Examples of processes being studied are air flotation thickening, addition of chemicals such as iron, alum, methanol, lime, polyelectrolyte and others for removal of phosphorus or for sludge conditioning.

RESEARCH TASK / PROJECT TITLE Compute the Cost of Various Alternative Sludge Handling and Disposal Schemes			FY 1973 TASK NUMBER 21ACT 08	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Smith Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$37,500	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to compute the capital, operating and maintenance costs for alternative sludge handling and disposal schemes for both primary and activated sludge municipal wastewater treatment plants. The processes to be considered are gravity sludge thickening, air flotation thickening, centrifugation, anaerobic digestion, aerobic digestion, elutriation, sludge storage, addition of chemicals, vacuum filters, filter presses, sand drying beds, multiple hearth incineration, and disposal on the land. A total of 181 separate sludge handling schemes have been identified using this set of processes. Mathematical models will be developed for each process and an Executive digital computer program will be used to solve all mass balance and sizing computations. Recycle streams from all processes will be returned to the main plant and the impact on the cost of the main plant will be computed. The results of the study will be cost estimates for each of the 181 separate schemes for handling and disposing of the sludges. The plants considered are conventional plants with no chemicals added for removal of phosphorus.

RESEARCH TASK/PROJECT TITLE The Economics of Combined Use of Dry Weather and Wet Weather Processes			FY 1973 TASK NUMBER 21ACT 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Smith Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$12,500

TASK/PROJECT DESCRIPTION AND REPORTS

A continuing problem in water pollution control is how to handle and treat storm and combined wastewater flows. If storm facilities are installed, these can be used to enhance the treatment of dry weather flows. Dry weather facilities might be increased in size to partially handle the wet weather flows. The purpose of this task is to investigate the optimum design procedure to maximize the cost-effectiveness of the combined installation for both dry and wet weather treatment.

WASTEWATER SYSTEM INSTRUMENTATION AND AUTOMATION

RESEARCH TASK / PROJECT TITLE State-of-the-Art Report on Instrumentation and Control in Wastewater Systems and Treatment Plants			FY 1973 TASK NUMBER 21ACU 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Allen E. Molvar, Environmental Systems Center Raytheon Company, Box 360 Portsmouth, Rhode Island 02871			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph F. Roesler Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 7/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$158,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to: survey the literature; survey the user experience of instrumentation and control systems and determine the performance of instrumentation in the field; design alternative control strategies for each wastewater treatment unit process; prepare a plant layout for a hypothetical 1 and 10 mgd facility; estimate the costs incurred, benefits derived and operating problems associated with actual or proposed process control schemes; and identify future research needs.

RESEARCH TASK / PROJECT TITLE Advanced Control Algorithms for the Activated Sludge Process			FY 1973 TASK NUMBER 21ACU 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ronald N. Doty, City of Palo Alto 250 Hamilton Avenue Palo Alto, California 94301			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Joseph F. Roesler Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/1/72	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$65,200 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives and descriptions of the work are to: evaluate seven schemes for control of the activated sludge process, including DO control, air return activated sludge control, sludge blanket control, MLSS control, feed forward TOC control, feed forward feedback TOC control, and respiration rate control; demonstrate the use of a digital computer for the implementation of advanced control methods; demonstrate value of advanced control methods on a full scale activated sludge process; and quantify cost and performance improvements associated with process control.

RESEARCH TASK/PROJECT TITLE Installation of Instrumentation and Control Devices for Three-Stage Activated Sludge			FY 1973 TASK NUMBER 21ACU 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Walter W. Schuk, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. NERC-Cincinnati, EPA, Washington, D.C.	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$60,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are: (1) to install and evaluate process sensors such as Technicon autoanalyzers for measurement of COD, phosphorus, NH_3 and NO_3^- , D.O. probes, magnetic flow meters, etc., and control devices such as valves, metering pumps, automatic chemical feeders in the three-stage activated sludge treatment pilot plant; (2) to evaluate and to modify the sensors and control devices for use in analog control loops; and (3) to assemble the devices in analog control loops for control of alum or FeCl_3 feed for phosphorus removal, methanol feed for denitrification, lime for pH control in nitrification, D.O. in the aeration basins, sludge wasting for the system, and, if suitable sensors can be obtained, the control of the food to mass (F/M) ratio in the first stage activated sludge system. The progress to date, includes the development of an empirical relationship to linearize the output of the Technicon autoanalyzers, the installation and successful analog operation of flow-proportional (feed forward) pH-error (feedback control of lime in the nitrification system) the development of a feed forward mass (NO_3^-)-proportional control loop for methanol feed in denitrification.

RESEARCH TASK/PROJECT TITLE Development of Analog Responses Data for Analog and Digital Control of Physical-Chemical Treatment			FY 1973 TASK NUMBER 21ACU 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR OR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Walter W. Schuk, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. NERC-Cincinnati, EPA, Washington, D.C.	
BEGINNING DATE 7/1/72	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$37,500

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to develop and to evaluate closed and open loop response data of an existing analog control system for physical-chemical treatment of raw wastewater. The physical-chemical treatment of raw wastewater. The physical-chemical treatment system consists of two-stage lime treatment (lime precipitation at pH 11.5, recarbonation to pH 9.5 and settling of the CaCO_3 produced by recarbonation), dual media filtration, two-stage chlorination (chlorine addition for pH reduction to 7 followed by chlorine addition for oxidation of NH_3 to N_2), and carbon adsorption. The feed forward-feedback analog control loops are flow-proportional (feed forward) pH-error (feedback) control of lime, CO_2 in lime treatment and Cl_2 feed in the first chlorination stage and mass - (NH_3) - proportional (feed forward) residual-free-chlorine error (feedback) and mass (Cl_2) proportional pH error for respective control of Cl_2 and base (NaOH) in breakpoint chlorination. The feed forward systems are flow proportional controls of FeCl_3 in the recarbonation, and sludge wasting in the two lime settlers. The analog response data has been developed for the control loop and is being used to evaluate the analog systems and, in another study, to develop control algorithms for digital process control of physical-chemical treatment.

RESEARCH TASK/PROJECT TITLE Automation of Physical-Chemical and Three-Stage Activated Sludge Systems			FY 1973 TASK NUMBER 21ACU 09	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert B. Yarrington, Dept. of Environmental Services Government of the District of Columbia 415 12th Street, N.W., Washington, D.C. 20004			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE 7/71 (G) 10/1/72 (C)	EST. COMP. DATE 4/1/73 (G) 9/30/73 (C)	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION \$150,000 (G) (69) Federal Cost: \$ 41,000 (C)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to develop digital control algorithms for physical chemical treatment of raw waste-waters, to evaluate these control algorithms with an IBM System 7 process control computer on the pilot physical-chemical treatment system and to evaluate an analog control system in the three-stage activated sludge treatment in the EPA-DC Pilot Plant. Closed and open loop analog response data developed by the EPA on an existing analog control system, is being used by the District of Columbia and IBM, to develop digital control algorithms for four feed-forward feed-back control loops and three feed-forward loops in the physical-chemical system. The feed-forward feed-back control loops are flow-proportional pH-error control of lime and CO₂ in lime treatment, and Cl₂ in pH reduction, and, in breakpoint chlorination, mass-proportional Cl₂ in error control of Cl₂ and mass-proportional pH-error control of NaOH.

The feed-forward loops are flow-proportional control of FeCl₃ and sludge wasting in the two-stage lime treatment process. To-date, the control algorithms have been developed and confirmed by IBM with simulation techniques. The system 7 computer is installed and on-line evaluation of the control systems is proceeding. The evaluation of the analog control system in the three-stage activated sludge system is beginning and will be used in a later study to develop digital control of portions of the three-stage activated sludge system.

RESEARCH TASK/PROJECT TITLE Evaluation of Two Ammonia Probes			FY 1973 TASK NUMBER 21ACU 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Williams Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/72	EST. COMP. DATE 7/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$11,700	

TASK/PROJECT DESCRIPTION AND REPORTS

Two ammonia probes will be evaluated for application to control of monitoring of wastewater treatment plant effluents.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Wastewater Sample Transfer and Conditioning System			21ACU 14	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Allen Molvar, Environmental Systems Center Raytheon Company, P. O. Box 360 Portsmouth, Rhode Island 02871			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert H. Wise Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/73	9/30/74	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$82,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The proposed program is designed to furnish on-line process hardware which will automatically sample, blend, transfer, and condition all types of wastewater treatment process streams for appropriate automatic analyses without the occurrence of unacceptable chemical changes in the sample during any of these three steps. This type of reliable sampling system is necessary for continuous automated analyses which will also permit cost-effective feed forward process control.

The prototype hardware system will be evaluated by the contractor at a suitable wastewater treatment plant; it will then be incorporated into a process-control demonstration project.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Digital Automation of the Three-Stage Activated Sludge System			21ACU 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert B. Yarrington, Dept. of Environmental Services Government of the District of Columbia 415 12th St., N.W., Washington, D.C. 20004			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dolloff F. Bishop, EPA-DC Pilot Plant 5000 Overlook Avenue, S.W. Washington, D.C. 20032	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
10/1/72	9/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$153,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives are to develop digital control algorithms needed in the three-stage (BOD, nitrification, denitrification) activated sludge for process control; to evaluate these control algorithms with an IBM system 7 process control computer on the three-stage activated sludge pilot system at the EPA-DC Pilot Plant; and to develop digital data acquisition programs for the three-stage activated sludge system. The three-stage activated sludge system consists of an activated sludge stage with mineral addition (alum or FeCl_3) for BOD and phosphorus removal, nitrification and denitrification with methanol and mineral addition for nitrogen and residual phosphorus removal, and filtration for residual solids removal. The control loops for chemical feed of methanol or minerals (alum or FeCl_3) are mass - (P or NO_3) - proportional feed-forward systems; for sludge wasting, flow-proportional feed-forward systems, for D.O. control, a complex feed-forward feed-back system based on flow, and recycle, D.O. uptake rate, oxygen transfer efficiency, and D.O. error deviation from set point. Any F/M control will require sensor evaluation and analog development.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Investigate the Effectiveness of Process Control by Computation			21ACU 33
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Smith Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	6/30/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$12,500

TASK/PROJECT DESCRIPTION AND REPORTS

A time dependent model for the activated sludge process has been developed and this model will be used to investigate the potential effectiveness of automatic control schemes such as dissolved oxygen control, control of mixed liquor suspended solids concentration by means of wasting control, sludge storage, or other means. The advantages of an equalization basin upstream of the primary settler will be studied. PID control of dissolved oxygen has been completed. The validity of the study will be limited by the existing poor relationships for the rate constant in the aerator and by the poor model for the final settler.

Some field data from a full sized plant is expected from Task 21ACU 04, and these will be used to validate the model.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Evaluation of Instruments for Control of Wastewater Treatment Systems			21ACU 41
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Wise Advanced Waste Treatment Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
8/1/72	12/1/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$22,500

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of the work are to evaluate instruments or equipment which show a potential application for control or monitoring of wastewater systems. The instruments would be evaluated in regard to their accuracy, dependability, and maintenance-free operation when operated on-line in a pilot or full-scale plant. This program is planned to be continued in FY '74 under Task 21ASC 307.

WATER SUPPLY HEALTH EFFECTS RESEARCH 1C1046

OUTPUT: Development of valid criteria for promulgating water quality standards for municipal (drinking) and recreational (freshwater and marine) uses. Research effort includes studies of biological effects resulting from the presence of infectious agents and potentially toxic contaminants in the water environment. The goal of the program is to assure public health and pleasing aesthetics.

ESTABLISH HEALTH CRITERIA FOR UNKNOWN ORGANIC CONTAMINANTS OF DRINKING WATER

RESEARCH TASK/PROJECT TITLE Establish Health Criteria for Unknown Organic Contaminants of Drinking Water: Part I - Chemistry			FY 1973 TASK NUMBER 21APV 01-05 & 12	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert G. Tardiff Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/71	EST. COMP. DATE 6/77	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$184,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to concentrate and extract the organic compounds in drinking water for toxicity testing and to characterize and identify the toxins from the most toxic fractions. The overall objective is to develop health-related criteria for the development of a drinking water standard for organics. Concentration will be accomplished through the use of reverse osmosis with multiple membranes. Extraction and partitioning will be accomplished by lyophilization and solvent extraction. Other partitioning methods employed include gel permeation, ion exchange, gas chromatography and liquid chromatography. Identification methods applied include GC-Mass Spectrometry, NMR spectroscopy, and IR and UV-Vis spectrophotometry.

At present, progress has been made in the development of standardized procedures for concentration and extraction. Work is being carried out on the evaluation of various RO membranes and different ion exchange resins. Work is being carried out on the evaluation of the potential benefit of using TOC as a monitoring tool.

RESEARCH TASK/PROJECT TITLE Establish Health Criteria for Unknown Organic Contaminants of Drinking Water: Part II - Toxicology			FY 1973 TASK NUMBER 21APV 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert G. Tardiff Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/71	EST. COMP. DATE 6/77	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$20,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to assess the toxicity of fractions and concentrates of organic compounds isolated from tap water. The overall objective is to develop health-related criteria for the development of a drinking water standard for organics. The project is composed of 2 parts: (1) Gross screening of organic fractions for classification of acute toxicity (including LD₅₀, Cumulative Index, sensitization potential, and potential interaction); and (2) In-depth subacute toxicity studies (histopathologic, physiologic, and biochemical).

Only a few samples have been obtained for toxicity testing. The quantities of each were sufficient only to conduct LD₅₀ studies. The samples tested were classified as "very toxic," i.e., having an LD₅₀ between 50 and 500 mg/kg.

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SCREENING OF KNOWN CHEMICALS FOR SPECIFIC TOXIC EFFECTS

RESEARCH TASK / PROJECT TITLE Screening of Known Chemicals for Specific Toxic Effects		FY 1973 TASK NUMBER 21APW 2, 3, 8, 13, 15, 19, 21, 28, 29, & 30	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Gunther F. Craun Water Supply Research Laboratory NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/71	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$310,600

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to develop and apply methods of general application for screening the effects of environmental chemicals on various biologic systems. The systems are used to establish effect parameters that can be used to develop and correlate with biochemical indicators of effect in more accessible tissues for sampling in field investigations. Determine the magnitude of exposure to environmental chemicals by assaying drinking water and human hair.

RESEARCH TASK / PROJECT TITLE The Role of Silicates in the Etiopathogenesis of Endemic Nephropathy		FY 1973 TASK NUMBER 21APW 34	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Antal Bata, Institute of Pathologic Physiology Belgrade University Medical School Belgrade, Yugoslavia		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Leland J. McCabe Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/72	EST. COMP. DATE 9/76	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION (PL-480 Funds) Federal Cost: \$73,000

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this PL-480 project is to clarify the possible role of silicates in endemic nephropathy and provide basic information about silicates in drinking water and any harmful effects from a wide range of exposure in the water. The results will be helpful to EPA in considering the need for inclusion of silica in U.S. Drinking Water Standards

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INVESTIGATE PROBLEMS OF WATERBORNE DISEASE

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Maintain Current Awareness of Waterborne Disease Outbreaks			21APX 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Gunther F. Craun Water Supply Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
1/46	Continuing	☐ Contract ☐ Grant ☒ Intramural		Federal Cost: \$12,500

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this long established project are to assist the Epidemic Intelligence Officers of the Center for Disease Control, HEW, in the investigation of outbreaks to determine the deficiency in water supply that allowed the outbreak to occur, and to summarize the causes of waterborne outbreaks on a periodic basis.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
North Carolina Disease Analysis			21APX 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Frederick E. Hamblet Water Supply Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
6/73	6/78	☐ Contract ☐ Grant ☒ Intramural		Federal Cost: \$30,000

TASK/PROJECT DESCRIPTION AND REPORTS

Ten years of disease data on poliomyelitis, leukemia and infectious hepatitis are being analyzed in relation to the source of water supply for five river basins in North Carolina. The supplies are categorized as individual supplies, municipal wells, municipal creek supply and municipal river supplies. Preliminary results show that in poliomyelitis and infectious hepatitis disease rates are highest with private supplies, lowest with municipal wells, and intermediate in the creek and river supplies.

RESEARCH TASK/PROJECT TITLE Study Water Supplies for the Occurrence of Viruses and Other Pathogens			FY 1973 TASK NUMBER 21APX 8-10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Norman A. Clarke Water Supply Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 6/72	EST. COMP. DATE 6/76	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural		FUNDING INFORMATION Federal Cost: \$272,500

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine the efficacy of four different techniques for concentrating small numbers of viruses from large volumes of treated water and to concomitantly determine if a relationship exists between the presence or absence of viruses and other microbiological pathogens and indicator bacteria.

Nine different water supplies in widely scattered geographical areas of the United States are being studied. If pathogens are detected in treated water, corroborative epidemiological studies will be initiated to determine the significance of such findings. Results will be used to develop new criteria for changes in drinking water standards and water treatment techniques.

RESEARCH TASK/PROJECT TITLE Detection of Viruses in Water: Methodology Improvement			FY 1973 TASK NUMBER 21APX 16-18	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Norman A. Clarke Water Supply Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 6/72	EST. COMP. DATE 6/76	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural		FUNDING INFORMATION Federal Cost: \$95,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to improve methods used to concentrate small numbers of viruses from large volumes of water. Three basic techniques for concentrating viruses from water are being studied to improve their efficacy. The methods include flow through samplers, sequential techniques (membrane type filters followed by polymer two-phase separation), and adsorbent techniques (PE 60, activated carbon).

REVIEW SAFETY OF PRODUCTS USED IN WATER TREATMENT,
STORAGE, AND DISTRIBUTION, AND UNIQUE WATER SOURCES

RESEARCH TASK/PROJECT TITLE Review Safety of Products Used in Water Treatment, Storage and Distribution		FY 1973 TASK NUMBER 21APY 3 & 12	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Benjamin Pringle, NE Water Supply Res. Lab South Ferry Rd. NERC-Cincinnati, EPA, Narragansett, R.I.	
BEGINNING DATE 7/68	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$60,000
TASK/PROJECT DESCRIPTION AND REPORTS			

The objectives are to develop protocols and policies for the evaluation of water treatment chemicals; determine the best means of toxicologically and chemically testing the different types of water treatment chemicals; promulgate the protocols; evaluate data submitted to determine safety-hazard to the population from the intended use of the products; and determine maximum safe levels for emergency situations.

CRITERIA FOR RECREATIONAL WATERS

RESEARCH TASK/PROJECT TITLE Recreational Water Quality Measurements			FY 1973 TASK NUMBER 21APZ 01, 09-14	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Victor J. Cabelli, NE Water Supply Res. Lab South Ferry Road, NERC-Cincinnati, EPA Narragansett, Rhode Island 02882		
BEGINNING DATE 7/71	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural		FUNDING INFORMATION Federal Cost: \$200,200

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to develop and evaluate techniques for measuring water quality that relate to health effects on recreaters. Pathogens capable of health effects and multiplication in nutrient or thermal polluted waters will be quantified. Studies of health effects will be preceded by method adaptation to identify and quantify significant health effects and health effectors/indicators.

RESEARCH TASK/PROJECT TITLE Pretest of Epidemiological Methods for Bathing Beach Study			FY 1973 TASK NUMBER 21APZ 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Paul W. Habermann, Center for Policy Research 476 Riverside Drive New York, New York 10027		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Victor J. Cabelli, NE Water Supply Res. Lab South Ferry Road, NERC-Cincinnati, EPA Narragansett, Rhode Island 02882		
BEGINNING DATE 6/73	EST. COMP. DATE 5/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$87,229

TASK/PROJECT DESCRIPTION AND REPORTS

This project is to determine whether test beaches selected are, in fact, suitable as regards the demographic characteristics and bathing activities of the populations at the beaches on weekends; to pretest the "Illness Inquiry System" as a means of obtaining accurate and unbiased data on the incidence of illness among populations swimming at the test beaches, and to define the relevant methods of data collection and analysis.

Interviews and follow-up required inquiries by mail, phone, and personal interviews will be conducted to determine if the required quality and quantity of information can be obtained from populations using the NYC Beaches on summer weekends. An inquiry system has been developed and will be tested on weekends during the summer of 1973.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
Study Etiology of Amebic Meningoencephalitis			21APZ 20-21
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Shih L. Chang Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/71	6/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$60,000

TASK/PROJECT DESCRIPTION AND REPORTS

Examine clinical material from cases of meningoencephalitis. Determine the distribution of free-living and pathogenic amoeba, especially Naegleria species, in fresh water lakes relative to nutrient pollution and other environmental data.

WATER SUPPLY CONTROL TECHNOLOGY 1C2047

OUTPUT: New or improved technology for the effective and economical control of drinking water contaminants during storage, treatment, and distribution. Program efforts will be directed to demonstrate technologies for removal of infectious agents, potentially toxic or aesthetically displeasing contaminants so that municipal sectors will be able to achieve compliance with present and future water quality standards. Improved methods of operating both new and existing water supply facilities will be developed and demonstrated.

EVALUATION AND IMPROVEMENT OF TREATMENT PROCESSES FOR THE
REMOVAL OF TRACE ORGANICS AND TASTES AND ODORS

RESEARCH TASK / PROJECT TITLE Evaluation and Improvement of Treatment Processes to Remove Trace Organics and Tastes and Odors			FY 1973 TASK NUMBER 21AQB 02, 04, 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James M. Symons Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 11/69	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☒ Intramural ☐ Grant	FUNDING INFORMATION Federal Cost: \$93,000	

TASK / PROJECT DESCRIPTION AND REPORTS

In present practice, the most common method of organic and taste and odor control is the use of activated carbon, either granular or powdered, to adsorb organics. This technique has deficiencies, both operational and economic. This situation must change if consumers are to be provided with esthetically pleasing and healthful drinking water. A three-way research approach will be used. One, a study will be conducted, on the organic content of drinking water around the country; two, field studies on existing systems will be continued to better understand their performance; and three, bench- and pilot-scale studies on activated carbon, other adsorbents, and oxidants.

EVALUATION AND IMPROVEMENT OF TREATMENT PROCESSES FOR REMOVAL OF
TURBIDITY AND SPECIFIC PARTICLES

RESEARCH TASK/PROJECT TITLE Evaluation and Improvement of Treatment Processes for Removal of Turbidity and Specific Particles		FY 1973 TASK NUMBER 21AQC 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James M. Symons Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 3/72	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$16,000

TASK/PROJECT DESCRIPTION AND REPORTS

Two major problems exist, the sludge produced from turbidity removal plants and economical turbidity removal from relatively clear water. Techniques for turbidity removal at: (1) high water flow rates; and (2) with minimum sludge production must be studied as well as sludge disposal methods. Pilot plant and field scale studies on waters of various composition, using various combinations of coagulants, coagulant aids, and filter aids on various types of granular beds should be performed. Bench-scale studies on water plant sludge are performed.

EVALUATION AND IMPROVEMENT OF TREATMENT PROCESSES FOR THE
REMOVAL OF TRACE METALS AND NITRATES

RESEARCH TASK / PROJECT TITLE Evaluation and Improvement of Treatment Processes for the Removal of Trace Metals and Nitrates		FY 1973 TASK NUMBER 21AQD 02-04 & 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James M. Symons Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 11/71	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$82,000

TASK / PROJECT DESCRIPTION AND REPORTS

The state-of-the-art on the removal of trace metals during conventional water treatment processes is not complete. Nitrates are known not to be removed so new treatment methods must be evaluated. Study the fate of As, Ba, Cd, Se, Cr, and Hg during coagulation, softening, and activated carbon treatment. Bench- and pilot-scale experiments are necessary. Study performance of nitrate selective anion exchange resins using hard, high nitrate waters.

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EVALUATION AND IMPROVEMENT OF METHODS FOR KILLING OR INACTIVATING
MICROORGANISMS IN DRINKING WATER

RESEARCH TASK/PROJECT TITLE Evaluation and Improvement of Methods for Killing or Inactivating Microorganisms in Drinking Water		FY 1973 TASK NUMBER 21AQE 03-04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Helen Seraichekas, NE Water Supply Res. Lab South Ferry Road, NERC-Cincinnati, EPA Narragansett, Rhode Island 02822	
BEGINNING DATE 7/69	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$86,000

TASK/PROJECT DESCRIPTION AND REPORTS

Disinfection is the crucial step of water treatment in killing biological pollutants. This project has examined thirty strains of enteric virus under identical experimental conditions. Data indicate that virus resistance to chlorine is wholly unpredictable and varies over a wide range and data on bacterial pathogen disinfection must be translated into practical design criteria. The difference in resistance of the purified virus from naturally occurring virus, will be determined. The source of the latter will include feces from children who just received polio vaccine and those who became ill from various viral infections. The various environmental factors which may affect the efficiency of water disinfection such as turbidity, will be clearly defined. Finally, the viricidal effect of chlorine and other disinfectants will be evaluated in pilot plant and actual treatment plant using attenuated virus strains.

EVALUATION AND PREVENTION OF CHEMICAL QUALITY DETERIORATION DURING THE
DISTRIBUTION OF DRINKING WATER

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Development of Water Quality Monitor for Distribution Systems			21AQF 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Nina I. McClelland National Sanitation Foundation NSF Building, Ann Arbor, Michigan 48105			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James M. Symons Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/69	10/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$15,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The purpose of this project is to develop a mobile water quality monitor that will permit the investigation of the deterioration, if any, of drinking water from the point of production to the point of use. The monitor will measure continuously or semi-continuously 15 water quality parameters.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Evaluation and Prevention of Chemical Quality Deterioration During the Distribution of Drinking Water			21AQF 04-05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James M. Symons Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	6/78	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$98,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The 1969 Community Water Supply Study showed the occurrence of toxic metals at consumers' taps when none existed in the finished water. Little is known about what conditions cause or enhance this problem and what treatment measures would prevent this occurrence. Studies on chemical water quality changes during distribution for waters of different character, relating them to type of piping and nature of treatment practices. Once the extent of the problem is known, effect of changes in treatment practice should be studied.

STUDY OF THE BEHAVIOR AND CONTROL OF CONTAMINANTS AND ADDITIVES IN
DRINKING WATER SOURCES DURING STORAGE

RESEARCH TASK / PROJECT TITLE Study of the Behavior and Control of Contaminants and Additives in Drinking Water Sources During Storage		FY 1973 TASK NUMBER 21 AQG 03-04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER James M. Symons Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/69	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$65,000

TASK / PROJECT DESCRIPTION AND REPORTS

Two major problems exist; one, natural processes that occur during storage and any deterioration in water quality must be controlled; and two, the effect of chemical additives for controlling water quality must be fully known. Three specific problems will be investigated in the early phases of the study. One, the fate of polymers, added to reservoirs for temporary turbidity control, will be studied. Two, the survival of indicator organisms and enteric bacteria pathogens in bottom muds will be determined. Three, the influence of artificial destratification for the control of plankton will be field tested.

EVALUATION AND CONTROL OF BACTERIAL QUALITY DETERIORATION OF POTABLE WATER IN
DISTRIBUTION SYSTEMS AND BOTTLED WATER SUPPLIES

RESEARCH TASK/PROJECT TITLE Evaluation and Control of Bacterial Quality Deterioration of Potable Water in Distribution Systems and Bottled Water			FY 1973 TASK NUMBER 21AQH 01-04 & 06
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Edwin E. Geldreich Water Supply Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 11/71	EST. COMP. DATE 6/78	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$111,500

TASK/PROJECT DESCRIPTION AND REPORTS

The problems associated with bacterial quality deterioration in distribution systems are vaguely recognized because of limited standard plate count measurements made on distribution water samples and even less attention to turbidity and chlorine residual in these waters. Studies will be made on maintenance of free chlorine residual and low bacterial nutrient levels in distribution networks as a means of controlling bacterial regrowth. Development of a continuous bacteriological monitoring system, after its feasibility is established by in-house research. Then equating this surveillance tool to Standard Methods procedures.

BEHAVIORAL RESEARCH 1D1312

OUTPUT: Improved understanding of human behavior and of materials systems as they relate to the generation and disposal of solid waste, leading to strategies for reducing solid waste loads and for increasing resource recovery.

STRATEGIES FOR REDUCING GENERATION OF SOLID WASTES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Decision Rules for Economic Efficiency in Solid Waste Management			24ABV 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR S. E. Jacobsen, Environmental Dynamics 1609 Westwood Boulevard Los Angeles, California			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Haynes Goddard Solid Waste Research Lab NRC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/1/73	1/31/74	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$40,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

Public policies relating to solid waste management will very likely rely heavily on economic incentives (or disincentives). To fully understand how these incentives can be effectively applied, there is an important need for disaggregated microeconomic models that incorporate the materials balance concept in terms of solid waste flows. A materials balance concept in terms of physical flows, has been formulated by resources for the future, but their model is too general for developing public policy. The overall purpose is to develop an explicit set of economic decision rules for attaining economic efficiency in solid waste management, based on the materials balance concept.

The microeconomic approach will provide a qualitative overview and identify critical economic decision points in residuals generation and flows. The analytical framework to be developed will be useful to research and policy analysts in solid waste management.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Analysis of the Feasibility of Pricing Mechanisms in Solid Waste Management			24ABV 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ulrich F. W. Ernst, ABT Associates 55 Wheeler Street Cambridge, Massachusetts 02138			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Haynes Goddard Solid Waste Research Lab NRC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/27/72	9/26/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$44,367	

TASK/PROJECT DESCRIPTION AND REPORTS

The theoretical efficiency and effectiveness of price mechanisms in alleviating resources are well demonstrated in a market type of economy. There are prevailing questions as to why such mechanisms can not or are not being used more extensively in solid waste management. One explanation is that the theory of pricing mechanisms as applied to solid waste management has not been sufficiently developed to-date. Thus, there is a definite need for thorough exploration of the feasibility of applying mechanisms in solid waste management. The approach is to incorporate the particular aspects of solid waste problems into price theory models. The research will identify operational pricing mechanisms that can be used to influence private sector decisions affecting solid waste generation, disposal, and recycling.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Improving Labor Productivity in Solid Waste Management			24ABV 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. L. Shell, Associate Professor University of Cincinnati Cincinnati, Ohio 45221		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Oscar W. Albrecht Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/30/72	6/30/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$123,957 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

It may be possible to improve the efficiency of solid waste management collection and disposal labor input through a scheme providing for wage incentives. The union/management/worker attitudes and interests wage incentives will be evaluated. The practicality of applying work measurements to various categories of collection and disposal tasks will be determined. A prototype wage incentive program will be designed and implemented in a selected municipality to assess its impact on total system costs.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Measuring Externalities Associated with Solid Waste Management			24ABV 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Richard Schmalensee, Institute for Policy Analysis 8961 Nottingham Place La Jolla, California 92037		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Paul Downing Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/72	2/28/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$41,400 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The existence of externalities generated by solid waste management techniques is well recognized, but the exact nature and extent of the external effects is less evident. The objective is to identify the exact nature of the externalities and develop measurement techniques to provide quantitative analyses. The proposed methodology will then be tested by application to operational data available for San Diego County, California.

RESEARCH TASK / PROJECT TITLE An Evaluation of Available Policy Instruments to Minimize Paper Residuals in the Commercial Sector			FY 1973 TASK NUMBER 24ABV 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Edward J. Beltrami, Public Systems Research P. O. Box 69 Stony Brook, New York		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Paul Downing Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$92,620 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The variables that determine solid waste residuals generation in the commercial sector, will be identified. The objective is to analyze proposed policy incentives aimed at minimizing residuals generation. An analysis will be made as a result of proposals that include effluent charges, raw material and finished product specifications, and raw material and product taxes.

RESEARCH TASK / PROJECT TITLE Operations Research Techniques Applied to Solid Waste Management			FY 1973 TASK NUMBER 24ABV 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Charles R. Glassey University of California Berkeley, California		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald Talley Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 5/31/75	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$55,340 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The series of specific problems involved in the planning and operation of solid waste management systems, will be studied through the use of operations research and mathematical economics. Specific problems to be evaluated include collection, processing, recycling, and disposal systems, and the location and design of operational facilities, including transfer stations. Queuing problems and load relationships between collection and transfer vehicles will also be considered.

RESEARCH TASK / PROJECT TITLE Metropolitan Housewives' Attitudes Towards Solid Waste Disposal			FY 1973 TASK NUMBER 24ABV 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Petterson Marzoni, Jr., National Analysts, Inc. 1015 Chestnut Street Philadelphia, Pennsylvania 19107		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard H. Ongerth Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/25/71	EST. COMP. DATE 7/31/72	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$72,775 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

A nationwide survey of 1200 homemakers was conducted. The purpose of the survey was to determine base-line data on housewives' conceptions and misconceptions on solid waste, recycling, and various resource recovery problems. Virtually all metropolitan housewives (90%) express a willingness to separate their trash into three categories--cans and bottles, newspapers, and all else--to facilitate recycling. If required, housewives (90%) would prefer to perform this separation themselves, rather than pay even one dollar per year to have the municipality do it for them. Further, only one housewife in eleven reports that it would be difficult for her to perform this separation. Between 30% and 45% of the housewives surveyed, reported that they are willing to change their purchasing habits to cut down on solid waste or facilitate an increase in recycling. Consumers believe that the responsibility for cause and clean-up of pollution and solid waste falls squarely on government and individuals; however, the costs should be shared by industry as well. The final report, entitled as above, is available from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151, as Report #PB 213 340.

RESEARCH TASK / PROJECT TITLE Annotated Bibliography on Hospital Solid Wastes, Collection, Treatment and Disposal			FY 1973 TASK NUMBER 24ABV 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Richard G. Bond, University of Minnesota 1225 Mayo Memorial Building Minneapolis, Minnesota 55455		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Oscar W. Albrecht Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$14,739 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

An annotated bibliography of the available literature, is being prepared on hospital solid waste collection, treatment, and disposal systems, including the literature on microbiological and health aspects related to the various systems. Various information systems and bibliographical sources will be searched for relevant information.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Federal Purchasing to Reduce Solid Waste			24ABV 14	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Jack Milgrom, Arthur D. Little, Inc. Acorn Park Cambridge, Massachusetts 02140			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Oscar W. Albrecht Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/28/71	4/1/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$127,270 (71)	

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives are: to identify federal procurement policies and practices that effect solid waste generation and recycling; and, to determine how the federal government's purchasing power can be used as an incentive to reduce the generation of solid waste and encourage recycling.

Federal specifications for procuring government purchased items are evaluated and the significance of these to the solid waste stream. The main commodity areas examined in depth, are paper, rubber, metals, and glass. The manner in which product performance characteristics would be affected by varying amounts of secondary materials are considered. Recommendations for specific changes in federal procurement practices and policies, are presently being formulated.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Secondary Fibre Recovery Incentive Analysis			24ABV 15	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR John Clement, Resource Planning Institute 14 Story Street Cambridge, Massachusetts 02139			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Oscar W. Albrecht Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
5/1/72	4/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$48,820 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

The task involves construction of an analytical framework for use in evaluating the potential effect of investment tax credits and depreciation allowances on firm decisions. The objective is to determine the effectiveness of various policy instruments designed to achieve increased capital investment in resource recovery plants and equipments for collecting, processing, and utilizing secondary fibres.

RESEARCH TASK/PROJECT TITLE Framework for Analyzing and Selecting Among Alternatives for Regional Solid Waste Management			FY 1973 TASK NUMBER 24ABV 19	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Benjamin H. Stevens Regional Science Research Institute Philadelphia, Pennsylvania		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald Talley Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 1/1/72	EST. COMP. DATE 12/31/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$90,917 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

Considerable interest and suggestions concerning economies of scale in regional solid waste management systems have been expressed. The economic feasibility of regional solid waste management will be investigated. Primary emphasis will be on the development of a model framework to facilitate analysis and selection among alternatives for regional solid waste management systems, including implications for regional economics.

RESEARCH TASK/PROJECT TITLE State-of-the-Art in Litter Collection			FY 1973 TASK NUMBER 24ABV 20	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Richard Ongerth Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 6/1/73	EST. COMP. DATE 7/1/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$40,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Various mechanical devices are currently being developed for litter pickup. The literature relating to new technology will be reviewed and personal contacts made with industry and municipalities to obtain data on costs and effectiveness. This information will be included in total systems costs for solid waste management.

RESEARCH TASK/PROJECT TITLE Effects of Alternative Pricing Mechanisms on Amounts of Household Refuse, Litter, and Total Systems Costs			FY 1973 TASK NUMBER 24ABV 22
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Oscar W. Albrecht Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/73	EST. COMP. DATE 6/30/74	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$39,000

TASK/PROJECT DESCRIPTION AND REPORTS

It has been suggested that positive marginal pricing shifts some responsibility for collecting household solid waste from individuals to the public through increased littering. The influence of incremental user charges on alternative means of self disposal, will be investigated. Implicit and explicit costs of alternative pricing mechanisms will be considered. The overall objectives are to evaluate the various pricing mechanisms in terms of their effects on total systems costs for household refuse collections and solid waste generated including litter.

COLLECTION AND PROCESSING TECHNOLOGY 1D2063

OUTPUT: (1) Storage, collection, and transportation technologies for both residential and commercial solid waste management; and (2) new or improved processes for efficient reduction of the amounts of solid wastes which must be disposed, including combustion, densification, and separations systems. These technologies will be used for the purpose of establishing standards and for planning and implementing programs relating to ultimate disposal and recycling schemes. Potential markets for materials reclaimed from residential, industrial, and agricultural wastes will be identified.

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EFFECTIVENESS AND MODELING OF URBAN STORAGE, COLLECTION
AND TRANSPORTATION PRACTICES

RESEARCH TASK/PROJECT TITLE Transferable Refuse Collection & Routing Package Including Manuals, Guides, & Associated Programs for use by Cities to Upgrade their Operations			FY 1973 TASK NUMBER 02AAE 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Jon C. Liebman, Professor of Environ. Engineering University of Illinois at Urbana-Champaign Urbana, Illinois 61801		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Donald A. Oberacker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/71	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$64,813

TASK/PROJECT DESCRIPTION AND REPORTS

This task involves a one year project which will lead to the development of a transferable solid waste collection districting and routing package. This package will be easy to use, flexible and easily adaptable to the collection problems of all interested cities, and will give local governments an immediate way to provide more efficient refuse collection. The data collection and analysis phases of the proposed effort will also build a receptive local administrator attitude toward, the more comprehensive, long range R&D efforts which will still be needed for a total systems approach to the entire solid waste management problem. This package will be implemented in five test cities, and a "proven package" will be available to all interested local governments. Regional seminars in three test cities will disseminate information on the package to a wide local government audience, and will allow the funding agency to link this effort to the broader scope and objectives of concurrent efforts in the solid waste management area.

RESEARCH TASK/PROJECT TITLE To Develop & Demonstrate Analytical Models to Aid in Solving of Operation, Investment, and Districting Problems in Solid Waste Collection			FY 1973 TASK NUMBER 02AAE 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR David H. Marks, Professor of Civil Engineering Massachusetts Institute of Technology, Room I-274 Cambridge, Massachusetts 02139		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Donald A. Oberacker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/15/71	EST. COMP. DATE 5/14/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$42,460

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to develop and extend, on a macro-scale or district by district basis, mathematical models in specific areas of the solid waste collection and disposal process. The purpose is to increase efficiency and reduce costs. These areas are: optimal location of facilities such as truck depots, transfer stations, and incinerators; study capital budgeting and investment criteria for solid waste management systems and develop guidelines; mathematically analyze routing and scheduling of collection vehicles operating over several districts; and study districting problems to find optimal subdistricts for collection purposes. The model and techniques proposed are natural extensions of previous work by Marks and Liebman. Through sensitivity analysis, the influence of alternative institutional arrangements, policy decisions, and social constraints will be studied. Finally, to test the validity and applicability of the models to be developed, data from the City of Brookline, Massachusetts, which has demonstrated cooperation in this research, will be used. The progress as of October 1972, has been good in the areas of community level model development and regional level model development. Under community level model development, the major accomplishment has been in analytically dividing an area into well defined collection assignments, specifically in dealing with an 8-truck 40 district problem in Brookline. This was accomplished with a heuristic algorithm developed under this grant. The regional level model has also been developed and is presently undergoing shakedown runs on the computer. Further expansion of this model is planned to include time variables and multiple source-sink situations for optimizing major facility location problems.

RESEARCH TASK/PROJECT TITLE Computer Program Utilizing Mathematical Optimization and Heuristic Algorithm for Routing of Collection Vehicles			FY 1973 TASK NUMBER 02AAE 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Costis Tvegas, Public Technology, Inc. 1140 Connecticut Avenue, N.W. Washington, D.C. 20036		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Albert J. Klee Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 9/72	EST. COMP. DATE 9/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$124,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this research is to study, on a micro-scale or street by street basis, the routing of solid waste collection vehicles in urban areas. The research is aimed at developing mathematical optimization as well as heuristic algorithms for the routing of these vehicles. The best of the algorithms will become part of a computer program, which will be designed for easy use by city officials and consulting engineers. Included will be a number of street layout situations within one district with combinations of one and two-way streets. Specifically, the research plan is to: further investigate of traveling salesman approaches; develop a mathematical optimal algorithm for the Chinese postman problem with bidirectional and unidirectional streets; develop mathematical optimal algorithms for solving the multiple-postman Chinese postman problems and the multiple-salesman traveling salesman problem; develop heuristic algorithms for the above problems; and incorporate the most promising algorithms in a computer program package designed for easy use and write the necessary users manual. The results as of October 1972, are: a new algorithm for the traveling salesman and the multiple-salesman problem was developed, but found to be inefficient; a mathematical method was developed for optimal (not heuristic) algorithm solutions to the postman approach for a network of directed (two-way) and undirected (one-way) streets; and work in continuing on the multiple-postman approach and at coding existing algorithms for ease of use.

RESEARCH TASK/PROJECT TITLE Routing Street Sweepers in Conjunction with Parking Regulations and Enforcement Procedures			FY 1973 TASK NUMBER 02AAE 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Alexander H. Levis, Professor of Elec. Engineering Polytechnic Institute, 333 Jay Street Brooklyn, New York 11201		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Donald A. Oberacker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/74	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$23,343

TASK/PROJECT DESCRIPTION AND REPORTS

Experiments will be conducted to develop and expand a data base used to investigate the relationship of on-street parking to street cleaning. The ultimate objective is to develop and optimize a model for constructing mechanized sweeper routes in conjunction with parking regulations, enforcement procedures, and other similar factors. The model will aid in predicting the effects of various sweeping policies and the interaction between solid waste collection, parking, parking violations, land use, street traffic. The current study takes full advantage of initial work at Brooklyn Polytech in this area, which dates back at least 18 months. A basic "data bank" already exists for a 300 block area of upper Manhattan, New York. The area is essentially equal to a New York City Sanitation Department district, and much has already been done in collecting generation rate and vehicle parking data. An effective procedure for optimizing sweeping of streets will aid in reducing the problems of overloading sewers. The study will also compliment other SWRL efforts including optimization of solid waste collection routing, districting, and facilities location.

RESEARCH TASK / PROJECT TITLE To Develop Criteria to Measure the Effectiveness of Urban Refuse Storage, Collection, and Transportation Practices		FY 1973 TASK NUMBER 02AAE 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR H. Donald Messer, President Messer Associates, Inc., 8555 16th Street Silver Spring, Maryland 20910		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Albert J. Klee Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/73	EST. COMP. DATE 5/31/74	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$89,447

TASK / PROJECT DESCRIPTION AND REPORTS

Perhaps between 75-80 percent of a solid waste system cost is due to storage, collection, and transportation, the remainder being attributable to disposal. Given an adequate accounting system, the monetary costs of a solid waste management system are much easier to compute than are the benefits produced and the nonmonetary cost incurred. Thus, although a community may have an accurate estimate of what it is spending upon its system, it often is uncertain as to whether or not it is receiving reasonable value in benefits returned, i.e., it has little or no idea of its system efficiency or "cost effectiveness." What is needed, then, is some measure of effectiveness or index for each of the system elements; storage, collection, and transportation. (NOTE: Land disposal and processing facilities such as incinerators and grinders, are excluded from the proposed scope of work as it is intended that they will be investigated at a later date. Transfer station operations, however, as they form part of a solid waste transportation system, are included.) In order then to either evaluate or optimize a solid waste storage, collection, and transportation system, the significant variables that reflect upon the performance of the system, must be identified, quantified, and combined by some model to produce one or more measures of effectiveness. The purpose of the proposed contract, therefore, is to develop effectiveness measures for the solid waste management functions of storage, collection, and transportation, and for the solid waste management system (exclusive of disposal) as a whole.

WET SYSTEMS FOR RESIDENTIAL REFUSE COLLECTION

RESEARCH TASK/PROJECT TITLE		FY 1973 TASK NUMBER	
Technical/Economic Feasibility Study of Wet Collection Systems		09ADA 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Peter M. Meier, Curran Associates, Inc. 182 Main Street Northampton, Massachusetts 01060		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Donald A. Oberacker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
8/9/72	8/8/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$138,123

TASK/PROJECT DESCRIPTION AND REPORTS

This research covers a systems analysis to technically review and economically evaluate wet pipelines for residential solid waste collection and transport by carrying out a rather detailed and computer-modelled study of the economics involved. Items such as rising labor costs, construction of facilities, recycling opportunities, and comparisons to existing and forecasted collection and transportation methods are included. The results should be a complete and accurate report on wet pipeline transport from an economic and social impact standpoint.

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TO DEVELOP AN INCINERATOR TEST FACILITY WHICH WILL PERMIT EVALUATION
OF OPERATING PARAMETERS, EMISSIONS AND CONSTRUCTION MATERIALS

RESEARCH TASK/PROJECT TITLE Experimental and Theoretical Program to Develop Criteria for The Design and Control of Municipal Incinerators			FY 1973 TASK NUMBER 24AIO 11
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Adel Sarofim, Associate Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue Cambridge, Massachusetts 02139		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 9/1/72	EST. COMP. DATE 9/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$70,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this research is to establish the design and control criteria essential for the efficient operation of incinerators. The effect that variables, such as refuse composition (particle size, density, moisture content) and the amount and temperature of underfire air, have on the burning rate will be investigated. The development of control equipment criteria will be studied in conjunction with the degree of burnout observed in the fuel bed. An example of this would be control of underfire air as the refuse travels along the grate. As the degree of burnout is increased, the amount of underfire air would be decreased. One of the rate controlling steps in combustion is the pyrolysis of the organic fraction and, therefore, a parallel study in pyrolysis will be conducted to obtain information necessary for modeling the conditions in the fuel bed. Successful completion of this task will advance the state-of-the-art of incinerator design by further defining the combustion occurrences that take place in the fuel bed. In addition, the data necessary for the development of control equipment will also be generated.

RESEARCH TASK/PROJECT TITLE Overfire Air Mixing Study to Reduce Combustion Emissions in Municipal Incinerators			FY 1973 TASK NUMBER 24AIO 12
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Thomas J. Lamb, Arthur D. Little, Inc. Acorn Park Cambridge, Massachusetts 02140		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$84,000

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to conduct an overfire air mixing study to reduce combustible emissions in municipal incinerators. This work resulted from an earlier study which showed that combustible pollutants could be theoretically generated from the fuel bed and proposed the addition of jets in the secondary chamber to increase turbulence, thus prolong residence time and complete the combustion of the unburned fraction of pollutants.

The plan calls for determining the combustible fractions of pollutants during normal operating conditions. This will be followed by the installation and operation of jets in the secondary chamber. The difference in the concentration of combustible pollutants will be due to the additional turbulence created by the jets and, possibly, a mechanism to decrease the amount of pollutants emitted from municipal incinerators will result. Successful completion of this task will demonstrate another control technique that could be employed to help existing and new municipal incinerators bring combustible emissions under control.

RESEARCH TASK/PROJECT TITLE Pilot Scale Incinerator that will Simulate Conditions in Municipal Incinerators			FY 1973 TASK NUMBER 24AIO 13
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert Cutter, Owner & Vice President Jarvis Inc., 25 Ringe Avenue Extension Cambridge, Massachusetts		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$75,000

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to procure a pilot scale incinerator that will simulate conditions in municipal incinerators. The incinerator will be used to study the emissions from municipal incinerators and their relation to the operating parameters. A contract was awarded to furnish the Thermal Degradation Project with an incinerator that would simulate municipal conditions.

RESEARCH TASK/PROJECT TITLE Testing Capability to Investigate the Operating Parameters Associated with the Incineration of Municipal Solid Waste			FY 1973 TASK NUMBER 24AIO 14
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. W. Gerstle, Pedco Env. Specialists, Inc. Atkinson Square Cincinnati, Ohio 45246		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$24,000 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to obtain the testing capability to investigate the operating parameters associated with the incineration of solid waste. The Thermal Degradation Project was seriously handicapped by the lack of sampling and data collection manpower necessary to accomplish the goals of the in-house research. Therefore, this aspect of the work was contracted to an outside group, with the main emphasis being on the collection of particulate samples.

RESEARCH TASK/PROJECT TITLE Corrosion Problems and Relation of the Corrosion Rate to the Combustion Conditions			FY 1973 TASK NUMBER 24A10 15	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Dale Vaughn Battelle Memorial Institute, 505 King Avenue Columbus, Ohio			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. E. Loebker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/1/72	EST. COMP. DATE 5/1/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$60,000

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to study the corrosion problems and relation of the corrosion rate to the combustion conditions. Earlier work in this area revolved around the corrosion problems experienced by both combustion chambers and wet air pollution control devices. This work resulted in a wealth of metallurgical data as well as a proposed mechanism for the corrosion of metal parts of an incinerator. The present study is applying this work to the more specific problem of suspected corrosion agents and their concentration. The feed material into a municipal size unit was determined as well as the resulting corrosion. Next varying amounts of chloride was added in the form of PVC plastic and the change in the corrosion rate was noted; the difference being due to chloride and plastic addition. Additional tests are scheduled with the amount of chloride added being varied. This should show a dependence of the corrosion rate on chloride and give incinerator operators additional information on the incineration of chloride containing plastics. This research should better define the problems of incinerating plastics.

RESEARCH TASK/PROJECT TITLE Technical and Economic Feasibility of Using Molten Salt Pyrolysis Technology for Pyrolyzing Solid Waste			FY 1973 TASK NUMBER 26A10 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Vernon L. Hammond Battelle Memorial Institute, P.O. Box 999 Richland, Washington 99352			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Donald A. Oberacker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 10/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$76,442

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to determine the technical and economic feasibility of using molten salt pyrolysis technology for pyrolyzing solid waste. This technical and economic feasibility study should provide information about the economics of the molten salt system and what is needed to make it technically workable. Composition, degree of contamination, refuse preparation, ash removal, and methods of stoking refuse into the reactor are of interest. Work of this nature is needed to determine if molten salts are an effective tool in solid waste management.

RESEARCH TASK / PROJECT TITLE Relationships Between the Scrubber Water Effluent and the Corresponding Stack Conditions for a Given Input into the Scrubber			FY 1973 TASK NUMBER 24AIO 17
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

The task objective is to establish the relationships between the scrubber water effluent and the corresponding stack conditions for a given input into the scrubber. The research will determine the efficiency of the scrubber at various operating conditions. If done properly, this is important because it will eliminate one sample train and one sampling team during the incinerator test program. If the efficiency of the scrubber is known and furnace emissions are sampled ahead of the scrubber, the concentration of various pollutants in the stack can be accurately determined without actually sampling.

RESEARCH TASK / PROJECT TITLE Relationships Between the Operating Parameters of the Incinerator and the Resulting Particulate Emissions			FY 1973 TASK NUMBER 21AIO 18
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

The task objective is to establish the relationships between the operating parameters of the incinerator and the resulting particulate emissions. In attempting to improve incinerator practices, it was found that very little work had been done on correlating the operating parameters of the incinerator with the resulting emissions. This study will investigate the emission of particulates as a function of underfire air distribution, overfire air distribution, temperature, burning rate, and the composition of refuse. In all cases this study will attempt to close the energy and material balances as well as establish the relationships between emissions and operating parameters. Successful completion of this task will allow the optimization of incineration systems to achieve good combustion with minimal air pollution.

RESEARCH TASK/PROJECT TITLE Relationships Between the Gaseous Emissions and the Operating Parameters			FY 1973 TASK NUMBER 24AIO 19	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER R. C. Thurnau Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to establish the relationships between gaseous emissions and the operating parameters. If possible, this task will be conducted concurrently with Task 24AIO 18 and will be related to the same parameters as described in Task 24AIO 18. This study will investigate the emission as a function of underfire air distribution, overfire air distribution, temperature, burning rate, and the composition of refuse. In all cases this study will attempt to close the energy and material balances as well as establish the relationships between emissions and operating parameters. Successful completion of this task will allow the optimization of incineration systems to achieve good combustion with minimal air pollution.

RESEARCH TASK/PROJECT TITLE Relationships Between the Waterborne Effluent and the Operating Parameters			FY 1973 TASK NUMBER 24AIO 20	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER R. E. Loebker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to establish the relationships between the waterborne effluent and the operating parameters. If possible this task will be completed concurrently with Task 24AIO 18 and related to the same parameters as described in Task 24AIO 18. Successful completion of this task will allow the optimization of incinerator systems to achieve good combustion with minimal air and water pollution.

UNCLASSIFIED: INDUSTRIAL SOLID WASTE STUDIES

RESEARCH TASK/PROJECT TITLE Requirements for Effective Utilization of Municipal and Utility Sludges and Ashes			FY 1973 TASK NUMBER 90SWR 01	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Norman L. Hecht, University of Dayton Research Institute 300 College Park Avenue Dayton, Ohio 45409			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Daniel F. Bender Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/9/72	EST. COMP. DATE 6/8/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$31,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives are to (1) perform a comprehensive literature review and survey of the present municipal and utility sludge and ash production, disposal methods and utilization methods; (2) determine technical feasibility and economic practicality of more widespread application of present utilization methods; and (3) suggest new utilization methods with consideration of technical feasibility and economic practicality.

A search of the literature and contact with a variety of governmental and trade organizations who are producers and/or present or potential users of sludges and ashes are the methods to be used.

RESEARCH TASK/PROJECT TITLE Industrial Solid Waste Classification Systems			FY 1973 TASK NUMBER 90SWR 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Joan Berkowitz, Arthur D. Little, Inc. Acorn Park Cambridge, Massachusetts 02140			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Daniel F. Bender Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/30/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$76,571 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to design and test a detailed, practical, systematic classification system applicable to all solid wastes generated by industries in all divisions of the SIC codes. The project involves use of literature, personal interviews with government agencies, trade associations, university personnel, economists and salvagers, as well as plant visits for observation and testing of scheme.

Information of interest includes waste generation (quantities and properties), present handling procedures with emphasis on salvage operators (present and potential), and environmental impact.

RESEARCH TASK / PROJECT TITLE An Evaluation of Alternatives for Industrial Waste Management in the Chemical Industries			FY 1973 TASK NUMBER 90SWR 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Charles C. Humpstone, Vice President Intl. Research & Tech. Corp., 1225 Connecticut Ave., N.W. Washington, D.C. 20036		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Daniel F. Bender Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/30/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$59,798 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to develop and evaluate rational and implementable techniques and strategies for solid wastes from the chemical industry. The strategies and techniques will involve means of encouraging reuse by other or source industries, suggested and evaluated methods for the reuse or conversion of the wastes to useful raw or end product materials, suggested and evaluated methods for the safe and proper handling of the wastes and suggested and evaluated non-polluting, efficient methods of ultimate disposal where reuse is not feasible.

DISPOSAL TECHNOLOGY

1D2064

OUTPUT: Guidelines and/or policy decisions for sanitary landfill design, construction, and operation. Recommendations will be developed relative to dry versus wet land disposal and cover versus no cover landfill practices. Program efforts will produce methods for identification and control of gases and methods for the control and treatment of leachate. Reports will be compiled on pathogen survival, movement, and control; and design criteria will be established for settlement. This program will be conducted at both laboratory and field scales.

DEVELOP A COMPREHENSIVE UNDERSTANDING OF SOLID WASTE DISPOSAL IN SANITARY LANDFILLS
AND OF THE ENVIRONMENTAL IMPACT OF LANDFILLS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Marine Disposal of Fine-Grained Waste Solids			01AAC 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR M. Grant Gross, The Research Foundation of State University of New York, Marine Sciences Res. Ctr. Albany, New York 12224			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/1/70	8/31/72	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$68,410	

TASK/PROJECT DESCRIPTION AND REPORTS

This study is intended to characterize waste solids and marine solid accumulations, investigate their immediate environmental impact, and investigate processes involved in environmental interactions. The study will deal with the coastal waters of the New York Bight, specifically Long Island Sound, and off New York Harbor. The study will attempt to define and determine the extent of the problem. Studies will be conducted to find out the sources of the solids and their characteristics, geological and chemical interactions, their movement and distribution, how these effect the sediments, water and biological systems.

The ultimate goals are to establish predictive models and develop management systems to maximize beneficial uses.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Treatability of Leachate from Sanitary Landfills			01AAC 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert K. Ham, University of Wisconsin 3232 Civil Engineering Building Madison, Wisconsin 53706			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/70	12/72	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$61,523	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine the treatability of leachate from sanitary landfills by use of standard unit processes for wastewater treatment. The work is to be done in the laboratory using raw, natural leachate obtained from simulated landfill cells. Detailed analysis of each unit process is not anticipated, but a general overview of potential capability of different unit processes for treating leachate is expected. Progress reported after one year of this two-year grant, indicates biological treatment is more amenable to treating leachate than chemical methods. This is primarily due to the large quantities of chemicals required and resultant large volumes of sludges. Determination of the most feasible method of leachate treatment will be evaluated in the second year. This work will serve as the basis for future pilot plant studies.

RESEARCH TASK / PROJECT TITLE Bibliography - Influence of Solid Waste Management Practices on the Environment			FY 1973 TASK NUMBER 01AAC 07
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/72	EST. COMP. DATE 6/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$2,500

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this continuing activity is to compile, in a readily available source, pertinent articles describing the influence of various solid waste management practices on the quality of surface water and groundwater. Such information is frequently requested from other activities within EPA and from public and private interests outside of the EPA. The work done to-date, has been used by Government and private engineers and scientists, to more accurately assess the impact of solid waste management practices on the environment. Primary emphasis has been in the sanitary landfill area. Two reports have been published and future work will update these basic reports. The Solid Waste Information Retrieval System is used along with other sources, to perform this activity.

RESEARCH TASK / PROJECT TITLE Sanitary Landfill Stabilization with Leachate Recycling			FY 1973 TASK NUMBER 01AAC 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Frederick G. Pohland, Georgia Institute of Technology School of Civil Engineering Atlanta, Georgia 30332		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/71	EST. COMP. DATE 6/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$25,845

TASK / PROJECT DESCRIPTION AND REPORTS

Present scientific information on leachate characteristics, mechanisms of landfill decomposition, and leachate treatment is at best minimal. Substantial information on the feasibility of leachate recycle as a practical and useful method for accelerated landfill stabilization and leachate treatment, is needed before large scale application of this concept. In accordance with the above needs, 14-foot simulated landfills have been operated to determine the effect of leachate collection and recycle on the rate of stabilization within the fill, and the feasibility of using the fill as a treatment process for the constituents in the leachate. A review of the available literature has been completed, and has been included with experimental data as part of a special research problem report. Results indicate that stabilization of food and garden wastes is accelerated by just recycling leachate, and that addition of nutrients and seed, together with the control of pH, can enhance the rate of stabilization. Recommended design, operation and control methods applicable to conventional sanitary landfill practice, will be developed.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Determine the Feasibility of Spray Irrigation as a Leachate Treatment Method			01AAC 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/71	6/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$15,000	

TASK / PROJECT DESCRIPTION AND REPORTS

Numerous landfills in the United States have encountered problems with leachate emanating from solid waste and contaminating surface waters and/or groundwaters. Management of this problem is usually most difficult when treatment is found to be necessary before discharge of leachate to the environment. Since leachate contains large quantities of organic materials and possible toxic concentrations of metals, a practicable treatment scheme will be difficult to develop. Spray irrigation of leachate is a possible low-cost, on-site treatment scheme that warrants further investigation. Ten test plots, each of 21 square feet surface area, are used to evaluate the optimum loading rates on sandy soil and on a clay soil. Results to-date, indicate that a loading rate of 150 pounds BOD₅ per acre per day appear to have little detrimental effect of the bluegrass cover crop, and that percolate from 18 inches of soil indicates removal efficiencies from 50 to 95 percent for the organic and inorganic constituents of leachate. This work has been conducted during one growing season and definitely should be conducted over several years to determine the full impact of leachate on the soil and grass system. The promising use of this treatment scheme will greatly aid small landfill sites, as they are not readily equipped to evaluate such a system, yet must solve a very real leachate problem with limited resources.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Treatability of Leachate from Sanitary Landfills			01AAC 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert K. Ham, University of Wisconsin Department of Civil Engineering 3232 Civil Engr. Building, Madison, Wisconsin 53706			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/70	12/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$24,816	

TASK / PROJECT DESCRIPTION AND REPORTS

Treatment of leachate from landfills is a practical necessity in many cases. Where a sewerage system is available, treatment can be performed at the central plant; otherwise, treatment must be performed on-site. No performance data is available on lab, pilot, or traditional wastewater methods. This research grant effort is intended as a brief survey of treatment methods with pilot plant application of the most feasible. Detailed analyses of each method is not expected. The final outcome of this study will be a practical on-site treatment scheme and an evaluation of how much leachate can be added to conventional domestic wastewater treatment plants when leachate is discharged to a sewerage system. It has been determined that a conventional biological treatment plant can accept up to 10 percent leachate-domestic wastewater without effecting plant performance significantly. The most promising on-site treatment scheme appears to be anaerobic lagooning followed by aerobic polishing. A pilot plant has been established but results from this portion of work have not been obtained as yet.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Treatment of Leachate Generated from Sanitary Landfills			01AAC 12	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Edward S. K. Chian, University of Illinois Department of Civil Engineering Urbana, Illinois 61801		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dirk R. Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/72	11/74	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$170,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The treatment of leachate from many landfills in the United States is a practical necessity. Research presently underway is designed to give quick answers to the question of how to treat this liquid, since no lab, pilot, or field-scale data is available. A more detailed study is needed to determine process kinetics, the nature of the organic fraction of leachate, and the degree of treatment that may be obtainable using conventional wastewater treatment methods. In addition, other methods of removing pollutants from water are being studied because of small volumes and the vast range of contaminant concentrations and flow rates. The final report, due in September 1974, should provide the technical data needed to rationally design on-site leachate treatment schemes.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Evaluate an Experimental Landfill of High Ash Papermill Sludge			01AAC 13	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR O. B. Andersland, Michigan State University Division of Engineering Research East Lansing, Michigan 48823		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Kent S. Kisenbauer Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/71	5/31/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$68,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Land disposal of high ash pulp and papermill sludges introduces questions regarding the type of landfill construction most suitable for efficient operations and for extending the life of existing disposal sites. Very little information is available in the literature on the engineering behavior of papermill sludges placed in organized landfills or embankments. The objective of this project is to find a satisfactory method for the disposal of pulp and papermill sludges. The investigator has constructed, instrumented, and observed an experimental landfill of papermill sludge. Laboratory tests on high ash pulp and papermill sludges have been completed. The field test facility has been constructed and has been monitored for one year. Results to-date, indicate that a maximum settlement of 36 inches can occur over a period of one year for a 20-foot fill area. Correlations of pore pressure and total stresses with soil mechanics criteria, have been developed. However, the correlation between inorganic clay soils and papermill sludges for the angle of internal friction (landslide characteristics), does not appear to exist. Final field testing will attempt to provide the answers needed to develop this correlation.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Evaluation of Liner Materials Exposed to Leachate			01AAC 15	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Henry E. Haxo, Jr., Materials Res. & Development 2730 Adeline Street Oakland, California 94607			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Norbert B. Schomaker Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
3/5/73	4/5/76	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$79,981	

TASK / PROJECT DESCRIPTION AND REPORTS

The effective life of commonly-used liners for leachate collection over a range of conditions commonly encountered in various landfills, needs to be evaluated. The objective of this project is to evaluate various synthetic membranes, asphaltic concrete, and soil additives for containment and collection of leachate in landfills. It is anticipated that this effort will involve use of large lysimeters constructed in a laboratory.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Pollution of Subsurface Water by Sanitary Landfill			01AAC 16	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL			NAME, TITLE, AND ADDRESS OF EPA	
☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR A. A. Fungaroli, Drexel University 32nd & Chestnut Streets Philadelphia, Pennsylvania 19104			☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Dirk Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/66	1/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$48,932	

TASK / PROJECT DESCRIPTION AND REPORTS

The long-range objective of this study is to provide means for not only predicting the movement of contaminants from sanitary landfills in groundwaters, but also to develop methods of design and remedial procedures for reducing undesirable contaminant movement as well as various criteria for the evaluation of site suitability for sanitary landfill operations. The data's incorporation into mathematical models which will reliably predict the effects of sanitary landfill upon pollution of subsurface waters under the many diverse combinations of impossible conditions, is difficult at best and perhaps sometimes impossible. Some of these conditions are: quantity and schedule of precipitation, types of subsurface materials, aerial size of the sanitary landfill, depth of the landfill, character of the landfill materials, surrounding topography, and other factors. Mathematical design models are being developed from data obtained from monitoring controlled laboratory and field sanitary landfills. The models will describe the hydrologic functions of a sanitary landfill and site-geologic materials. It is expected that final models will be used in the determination of optimum landfill dimensions, soil cover thickness, potential remedial procedures for existing leaching landfills, and associated studies. Results to-date, have provided extensive long-term data concerning leachate quality during the most active years of decomposition. The present interest in leachate and the need for its control can in part, be credited to the data obtained under this research grant.

RESEARCH TASK/PROJECT TITLE Conduct Quality Controlled Evaluations of Selected Sanitary Landfill Processes			FY1973 TASK NUMBER 01AAC 17	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Dirk Brunner Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/71	EST. COMP. DATE 6/75	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$242,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Test cells are to be constructed in the same manner and under conditions similar to those which would occur under normal sanitary landfill operations. We will be able to duplicate existing landfill conditions and thereby eliminate the problem of scaling factors. Scaling factors occur when laboratory work is not directly equitable to field conditions. Because of the concern with the environmental effects of disposing solid waste on the land, various aspects of leachate, gas, and settlement will be investigated at the Boone County Field Site. Test Cell #1 was constructed as a control cell and was heavily instrumented to monitor gas, settlement, temperature, and leachate. This cell was also an integral part of the "Virus Survival and Movement Study." Test Cell #2 was constructed to be completely enclosed by a synthetic membrane in order to obtain quantitative and qualitative data on leachate generation. In addition, three 6-foot diameter simulated sanitary landfill cells will be compared to determine testing variability; the aggregate results will be compared to the performance of the lined, field-scale cell. Results from Test Cell 2 will be used to determine the direct applicability of conclusions from Test Cell 3 field conditions. Mass flow rates of leachate carrying pollutants will also be determined on a field-scale basis. Test Cell 3 will be a comprehensive investigation using 19 six-foot diameter simulated cells. The following conclusions can be made from results obtained to-date: (1) settlement has been negligible; (2) leachate characteristics from a field-scale cell are similar to those reported for laboratory-scale cells; and (3) methane production is slower in the field-scale cell than in most laboratory-scale cells.

RESEARCH TASK/PROJECT TITLE Equilibrium and Modeling Studies of Soil-Leachate Mixtures			FY1973 TASK NUMBER 01AAC 18(a)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Wallace Fuller, University of Arizona Dept. of Soils, Water and Engineering Tucson, Arizona 85721		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James A. Heidman Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 12/72	EST. COMP. DATE 6/75	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$137,337	

TASK/PROJECT DESCRIPTION AND REPORTS

The migration of leachate from a landfill occurs through the surrounding soil media. Soil can act as a filter for leachate contaminants. Therefore, the various attenuation mechanisms of soil need to be evaluated and related to leachate movement through the soils. This project will identify the attenuation mechanisms; evaluate pollutant attenuation of soils by column studies; develop simulation models for prediction of solute changes for water flow through soils. It is anticipated that empirical predictive equations relating to leachate pollutant attenuation in soils can be developed.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Leachate Migration Investigation in Large Soil Columns with Field Verification			01AAC 18(b)	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Neil F. Shimp, Illinois State Geological Survey Natural Research Building Urbana, Illinois 61801			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER James A. Heidman Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/73	8/75	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$115,954	

TASK/PROJECT DESCRIPTION AND REPORTS

The migration of leachate from a landfill occurs through the surrounding soil media. Soil can act as a filter for leachate contaminants. Therefore, the various attenuation mechanisms of soil need to be evaluated and related to leachate movement through the soils. This project will identify the attenuation mechanisms; evaluate pollutant attenuation of soils by column studies; develop simulation models for prediction of solute changes for water flow through soils. It is anticipated that empirical predictive equations relating to leachate pollutant attenuation in soils can be developed.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Survival and Movement of Viruses in Landfilled Solid Waste			01AAC 19	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Mirdza L. Peterson Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/71	6/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$25,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objectives of this project are to determine the survival patterns of viral pathogens in landfilled solid waste and to evaluate the potential contamination of water resources through leaching of viruses from a waste disposal site. Microbiologic monitoring of leachates from Cells #1 and #2 are being conducted in order to determine the degree of health hazard involved in solid waste disposal by landfilling. The results so far indicate that poliovirus may survive in compacted solid waste for at least 13 days at temperatures of 68-80°F, but the virus is inactivated in 2-4 days in a landfill with temperatures ranging from about 120-140°F.

RESEARCH TASK / PROJECT TITLE Time-Settlement Behavior of Processed Refuse			FY 1973 TASK NUMBER 01AAC 20	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Arley G. Franklin, Northwestern University Department of Civil Engineering Evanston, Illinois 60201			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Gregory Frank Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 3/1/71	EST. COMP. DATE 2/28/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$25,100	

TASK / PROJECT DESCRIPTION AND REPORTS

Among the primary problems associated with the reclamation of sanitary landfills sites, is the occurrence of large amounts of settlement resulting in structural damage and expensive compensating design features. The primary objective of this research is to develop a means of predicting settlement patterns within the landfill mass. Based on knowledge acquired from this effort, predictions for future settlement of currently existing landfills may be determined. In return, this information will assist in planning future landfills to expedite and to maximize the beneficial use of the completed fill site. Settlement characteristics as effected by biological and chemical activity, as well as mechanical processes, form the basis for predicting amounts of settlement and time of occurrence of settlement in sanitary landfills. Actual work currently in process, includes laboratory testing, data gathering, mathematical modeling, and computer programming. A formal report, based on work so far completed, is now under preparation.

RESEARCH TASK / PROJECT TITLE Develop and Evaluate a Process for Rapid Structural Stabilization of Sanitary Landfills by Injection Grouting			FY 1973 TASK NUMBER 01AAC 21	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Lyle K. Moulton, West Virginia University Engineering Science Building Morgantown, West Virginia 26506			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Kent S. Kisenbauer Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 2/1/70	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$41,382	

TASK / PROJECT DESCRIPTION AND REPORTS

The objective of this project is to determine the effect of different grout-refuse combinations on landfill strength and settlement characteristics. The influence of grout on biological decomposition and long-term landfill stabilization is also being determined. Time settlement data from lab and field testing are recorded and leachate analyses performed. The preliminary testing of various grouts and grouting materials in various combinations with refuse, has been completed. Laboratory results indicated that a grout composed of 50 percent fly ash and 50 percent water, was most beneficial for use in the field experiment. The evaluation of the grouted and ungrouted lab and field specimens indicated the grouted specimens produced a marked settlement reduction (less than 0.001 in./day) with a corresponding increase in the rate of anaerobic biological decomposition as measured by short chain fatty acids. This would tend to indicate an early biological stabilization. The leachate analyses indicated that the level of potential pollutants from the grouted specimens was higher than from the ungrouted specimens, but the quantity of leachate produced is considerably less in the grouted specimens. Thus, it would appear that the total amount of pollutants introduced into the surrounding soil media would be less than the amount introduced by an ungrouted landfill. To-date, some minimal results indicate that methane production was inhibited in the grouted refuse specimens. A final report will be prepared relating all investigative efforts, and with recommendations presented as to the (1) effectiveness of injection grouting of the landfills with inexpensive waste materials in accelerating the stabilization of sanitary landfills; and (2) reducing the production of leachate and gas.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Provide Analytical Support to Boone County Field Site			01 AAC 25	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Larry Elfers, PEDCO-Environmental Suite 8, Atkinson Square Cincinnati, Ohio 45246		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Daniel F. Bender Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/72	12/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$12,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The purpose of this task is to provide additional analytical capability for Task 01AAC 17. Rapid and timely results necessary for control of the various experiments conducted at the Boone County Field Site will be possible only with a contract such as this. Specific tests will be limited to routine water and solids tests.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Determination of the Effects of Compost on Selected Soils and Plants			01AAC 26	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR O. W. Kuchitzky, Tennessee Valley Authority 725 Edney Building Chattanooga, Tennessee 37401		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Carlton Wiles Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/1/71	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$67,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The task objective is to obtain data to help determine short- and long-term effects of compost produced from municipal refuse on selected soils and plants. Emphasis is being directed at determining use benefit relationships and the fate of heavy metals and other potentially toxic materials when the compost is applied to selected soils and plants. There is a dearth of data relative to what happens to waste material containing potential toxic substances when disposed of on the land. There is also an interest in more fully utilizing the land as a disposal sink and processing medium for various wastes (e.g., municipal refuse, industrial sludges, sludge wastewater, etc.). Completion of this task will provide some of the data not available relative to the fate of potentially toxic substances contained in wastes disposed of on land.

HAZARDOUS SOLID WASTES

1D2311

OUTPUT: Techniques for the characterization, collection, treatment and disposal of hazardous waste materials. These wastes may include among others: industrial and chemical wastes, hospital wastes, pathogenic wastes, pesticides and pesticide containers, and radioactive materials. An inventory of possible disposal sites for these materials will be compiled.

DEVELOPMENT OF TECHNIQUES FOR THE CHARACTERIZATION, TREATMENT AND DISPOSAL
OF HAZARDOUS WASTE MATERIALS, INCLUDING PESTICIDES

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Recommended Methods for Disposal of Hazardous Wastes			06ALR 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR R. Ottinger, Systems Group of TRW, Inc. One Space Park Redondo Beach, California 90278		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Henry Johnson Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
12/71	5/1/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$691,339 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

Based upon the findings of the Hazardous Waste Survey, the contractor is to recommend acceptable methods for the disposal of the listed hazardous wastes. Presently being determined is the effectiveness of current hazardous waste disposal practices, and recommendations involving other acceptable techniques and conducting research to modify or develop other handling and disposal techniques, will be made. Through these investigations it is anticipated that adequate methods for disposal of specific hazardous materials will be described.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Attitudinal Research on Disposal of Hazardous Wastes			06ALR 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR T. O. Jacobs, HumRRO 2210 Wynnton Road Columbus, Georgia 31906		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Henry Johnson Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/29/72	6/30/73	☒ Contract ☐ Grant ☐ Intramural	Federal Cost: \$136,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

This research involves attitudinal research, the results of which will be used to develop a public awareness program for the dissemination of information on hazardous wastes, to evaluate the psychological effects and the sociological impact of a system of regional sites to properly handle these wastes. It is anticipated that this research effort will alleviate objections and opposition to specific sites and will generate public support for a national disposal site system.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Non-Industrial Toxic and Hazardous Wastes			06ALR 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Seymour S. Block University of Florida Gainesville, Florida		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Mirdza L. Peterson Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
4/10/72	3/31/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$47,080	

TASK / PROJECT DESCRIPTION AND REPORTS

Prior research did not include municipal waste streams as a source of hazardous waste. This task will determine the types and quantities of hazardous waste in municipal streams. It is anticipated that this research effort will be a significant addendum to the overall hazardous waste program. It will provide a basis for deciding whether hazardous wastes in municipal streams should be considered for disposal at national disposal sites or some other collection and disposal system.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Toxicological Studies			06ALR 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Henry Johnson Solid Waste Research Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
11/72	11/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$34,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The degree of pollution caused by adding industrial waste mixtures to municipal refuse at sanitary landfill sites has not been determined. Since many industrial wastes are now and will be disposed of at sanitary landfills, it is necessary to study the environmental effects of leachate coming from such landfills. This study should involve toxicity tests and chemical analyses for general pollutants. The field activities will be associated with the simulated sanitary landfill studies (Task 01AAC 17). An interagency agreement with DOD will be used for gathering toxicity data on the leachates in question. The chemical analyses for the general pollutants will be performed in-house when possible. It is anticipated that the information gained from this case study will determine the feasibility of disposing of industrial waste mixtures at municipal refuse sanitary landfills.

RESOURCE RECOVERY TECHNOLOGY 1D2314

OUTPUT: (1) Methods and implementation activities which will stabilize the quantities of solid waste being generated; and (2) systems which will allow greater percentages of solid waste material collected to be recycled by energy recovery, material reuse, and materials conversion. The efforts of this element are related to four basic areas: solid waste generation behavioral studies, incentive studies, resource conservation studies, and reclamation technology development. Emphasis will be placed on shifting the relative economies of resource recovery by internalizing the external costs involved in virgin materials extraction and processing and in disposal.

FIELD TEST AND ANALYSIS OF PREPARED SOLID WASTE AS A FUEL IN A
VARIETY OF POWER AND HEATING BOILERS

RESEARCH TASK / PROJECT TITLE Pilot Plant Testing of the CPU-400: Solid Waste Conversion to Electricity			FY 1973 TASK NUMBER 05ABZ 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Frank Walton, Combustion Power Company, Inc. 1346 Willow Road Menlo Park, California			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard A. Chapman (on-site at Menlo Park) Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/23/67	EST. COMP. DATE 12/31/73	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$1,500,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objective is to determine the operating and performance characteristics of a completely-integrated pilot plant designed to convert the combustible component of municipal solid waste to usable electricity. The process utilizes a pressurized fluidized bed combustor to burn shredded, air-classified refuse, thereby generating hot gases which, after passing through inertial separators for particulate removal, are expanded through a gas turbine for power generation. The development of the process has gone through several stages. Following an initial feasibility study, extensive subscale experiments were performed utilizing a 12-inch diameter fluidized bed combustor. The process was then scaled up to its present daily capacity of approximately 100 tons of solid waste, or the equivalent of about 1 megawatt of generated electricity. A major effort involved the development of effective inertial separators. The fluidized bed combustor, now about 7 feet in diameter, underwent extensive testing which led to its present vertical configuration. Turbine integration is underway and this will be followed by a series of long-duration test runs designed to establish total system performance.

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THE STIMULATION OF PRIVATE INDUSTRY TO IMPROVE RESOURCE RECOVERY TECHNIQUES AND TO
DEVELOP PRODUCTS FROM RESOURCE RECOVERED COMMODITIES

RESEARCH TASK/PROJECT TITLE To Determine the Specifications for Input Required by Manufacturers for Recovered Materials			FY 1973 TASK NUMBER 06AKO 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Harvey Alter, Director of Research Programs National Center for Resource Recovery Washington, D.C. 20036		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. Olexsey Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$46,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to formulate a set of descriptive specifications for paper, glass, ferrous, and non-ferrous metals recovered from mixed municipal refuse. An evaluation procedure will be developed to determine the usefulness of the developed specifications to professional, trade, and private organizations. Meaningful specifications for materials recovered from refuse would provide criteria to aid product and process quality control for resource recovery systems.

RESEARCH TASK/PROJECT TITLE To Develop a Standardized Testing Procedure for Recovered Materials			FY 1973 TASK NUMBER 06AKO 03
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Harvey Alter, Director of Research Programs National Center for Resource Recovery Washington, D.C. 20036		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. Olexsey Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$49,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this task is to develop statistical sampling plans by which the solid waste product specifications developed in similar work, will be monitored. This means sampling and test procedures to monitor each unit operation in a resource recovery processing facility, as well as sampling plans for the products separated from municipal waste. In addition, the procedures necessary for testing and establishing the final specification must be chosen. The cost effectiveness of the entire sampling and test procedure is to be analyzed. Since any production oriented plant requires quality control measures for effective operation, a successful high volume refuse separation and recovery plant will require these same control devices.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER
To Determine the Role of Transportation in Resource Recovery			06AKO 04
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA	
☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Robert M. Sontheimer Resource Planning Institute, 14 Story Street Cambridge, Massachusetts 02139		☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Oscar W. Albrecht Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
7/1/72	6/30/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$55,000

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to provide an indepth analysis of the effects of transportation on the costs and operations of salvage firms. Specific aims are: (1) to quantify the actual transportation costs (inbound and outbound) as a percentage of firm sales and costs of goods sold; (2) to identify the freight rate considerations in purchasing and pricing policies; (3) to define the constraints on increased recycling that transportation costs place on salvage firms; and (4) to compare transportation costs for secondary materials with virgin materials for similar situations for a specific area. Phase I consists of data collection to characterize the operation of firms and identify internal and external factors affecting transportation considerations in the salvage industry. Phase II will include an analysis of the critical factors and determine the sensitivity of the transportation parameter on operations of salvage firms.

AN ANALYSIS OF THE IMPACT THAT FUTURE NATIONAL BEHAVIOR WILL HAVE ON
RESOURCE RECOVERY PROGRAM REQUIREMENTS

RESEARCH TASK/PROJECT TITLE Forecast of the Effects of Air and Water Pollution Controls on Solid Waste Generation			FY 1973 TASK NUMBER 09ABF 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Ralph Stone, President, Ralph Stone & Company, Inc. 10954 Santa Monica Boulevard Los Angeles, California 90025			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Ronald J. Talley Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 4/23/73	EST. COMP. DATE 3/23/74	METHOD OF SUPPORT ☒ Contract ☐ Grant ☐ Intramural		FUNDING INFORMATION Federal Cost: \$60,495

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to develop information relating the generation of solid waste to current and impending air and water pollution controls. Implementing these controls could result in sizeable increases in the Nation's solid waste load, and consequently could aggravate solid waste management problems. This contract will provide the information necessary to anticipate any such problems and develop appropriate responses in advance. This project will rely as much as possible on recent studies of the effects of air and water pollution controls on pollution sources (in particular, The Economics of Clean Air and The Economics of Clean Water) to derive estimates of the implications for solid waste generation of such controls. The contractor will provide any additional analyses necessary, not contained in available studies, to derive his estimates, although the emphasis will be on making use of available research as much as possible.

PROCESSES FOR SEPARATION AND RESOURCE RECOVERY OF
WASTES FROM MUNICIPAL REFUSE

RESEARCH TASK/PROJECT TITLE Solid Waste Reclamation Pilot Plant that Functions Through Material Coding and Subsequent Mechanical Sorting			FY 1973 TASK NUMBER 24AIN 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR David G. Wilson, Professor, Mechanical Engineering Mass. Institute of Tech., 77 Massachusetts Avenue Cambridge, Massachusetts 02139			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert Olexsey Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/1/72	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$99,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

This task involves the development and evaluation of various automatic sensing, coding, and separating devices for reclamation of municipal solid waste. The devices consist of a vortex classifier to effect gravity separations; infrared, impact, conductivity, spectroscopic and magnetic sensors; coding and information systems in conjunction with the sensor systems. Based upon results of laboratory evaluations of selected devices, the goal is to construct and evaluate a functioning pilot plant for the separation and reclamation of municipal solid waste. The plant may also have application for separation and reclamation of certain industrial solid wastes.

RESEARCH TASK/PROJECT TITLE Infrared Spectral Sensor to Facilitate Solid Waste Material Coding for Subsequent Separation			FY 1973 TASK NUMBER 24AIN 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Frank Winkler, Professor of Physics Middlebury College Middlebury, Vermont 05753			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Robert Olexsey Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 6/1/72	EST. COMP. DATE 5/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$24,000 (72)	

TASK/PROJECT DESCRIPTION AND REPORTS

The task objective is to develop and evaluate a sensor for the automatic identification of the various components present in municipal waste. The principle of the sensor is to identify materials based on reflected infrared radiation at a wavelength characteristic of each material. The task goal is to incorporate the sensor, with appropriate switching devices, into the refuse separation pilot plant being developed under Task 24AIN 06.

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RESEARCH TASK / PROJECT TITLE Mechanics of Refuse Size Reduction for the Purpose of Comminutor Design Specifically for Refuse Size Reduction			FY 1973 TASK NUMBER 24AIN 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR George Trezek, Professor of Mechanical Engineering University of California at Berkeley Berkeley, California		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER R. Olexsey Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$86,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The objectives of this research are to obtain fundamental data on the size reduction of municipal solid waste and provide a design of a machine specifically for the reduction of refuse. Engineering and mathematical principles will be employed to describe the fundamental mechanisms involved. Existing equipment employed for solid wastes processing are primarily devices designed for rock crushing and comminution of other brittle materials. This equipment has not exhibited any functional degree of reliability when applied to solid waste size reduction. Since reduction of solid waste has been extremely costly, successful completion of this research could aid in significantly reducing the cost of solid waste processing. This could greatly effect the economics of various resource recovery schemes and other solid waste management techniques.

RESEARCH TASK / PROJECT TITLE Optimal Pilot Plant Procedures for Production of Protein from Cellulosic Waste			FY 1973 TASK NUMBER 24AIN 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Charles Dunlap, Professor of Chemical Engineering Louisiana State University Baton Rouge, Louisiana 70803		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Charles J. Rogers Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 5/1/72	EST. COMP. DATE 4/30/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$78,000 (72)

TASK / PROJECT DESCRIPTION AND REPORTS

The task objective is to optimize an existing pilot plant for the production of single cell protein from cellulosic wastes. The pilot plant was designed to manage specialized solid wastes and not as an answer to the total municipal refuse problem. Homogeneous waste resulting from agricultural activities (e.g., straw, bagasse, sawdust, fruit and vegetables residues, etc.) can be processed into single cell protein for use as livestock feed. If process optimization proves economically feasible, the process will offer an attractive alternative to landfilling and incinerating this specialized type of solid wastes.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Fabrication of Single Cell Proteins from Cellulosic Waste			24AIN 10	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR William H. Daly, Associate Professor, Chemistry Louisiana State University Baton Rouge, Louisiana 70703			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Charles J. Rogers Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
8/8/72	8/8/73	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$21,868	

TASK / PROJECT DESCRIPTION AND REPORTS

Single cell protein produced from cellulosic waste has been proposed for use as animal feed. However, if large quantities of the protein are produced for animal feed, the conventional grain markets could be disrupted. Therefore, the objective of this research task is to develop expanded uses of the protein product. Potential products to be investigated are as follows: (1) isolation of the protein in pure form for use as dietary protein for human consumption; (2) incorporate the protein into fibers for use with synthetic fibers in the textile industry for improving drying properties; and (3) evaluation of the potentials of developing biodegradable packaging materials and adhesives. Successful development of alternative uses would lead to higher valued products and the higher cost benefits could make fermentation of selected cellulosic wastes a profitable resource recovery alternative to existing management of landfilling and incineration.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Pyrolytic Methodology for Conversion of Wood Wastes to Useful Products			24AIN 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Fred Shafizadeh, Professor of Wood Chemistry University of Montana Missoula, Montana 59801			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard A. Carnes Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
3/1/71	6/30/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$28,000	

TASK / PROJECT DESCRIPTION AND REPORTS

The conversion of wood residues and cellulosic waste materials to useful products using thermal degradation procedures, are being investigated. Thermal degradation presently yields a random mixture of products. The task objective is to control the undesirable side reactions and determine the conditions and/or catalysts required for selective conversion of the wastes to a few products acceptable for industrial uses.

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RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
Conversion of Waste Glass to Form Insulation			24AIN 12	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☒ PRINCIPAL INVESTIGATOR Ivan B. Cutler, Professor, Engineering The University of Utah Salt Lake City, Utah 84112			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Charles J. Rogers Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/26/72	6/25/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$28,530	

TASK / PROJECT DESCRIPTION AND REPORTS

In this country, more than five million tons of glass are discarded annually in municipal waste. Only a small percent of the discarded glass is recycled into reusable containers since constraints for doing so are great. Because of color and impurities, virgin rather than recovered glass is usually used by the industry. Since technology is available for the recovery of glass from municipal waste streams, the objective of this task is to develop foam glass insulation from waste glass and determine its market potential. The process being investigated has great potential as an inexpensive method for converting waste glass into a valuable insulation product.

RESEARCH TASK / PROJECT TITLE			FY 1973 TASK NUMBER	
To Study the Formation of Silicon Carbide from Rice Hulls			24AIN 13	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR I. B. Cutler, Professor, Engineering University of Utah Salt Lake City, Utah 84112			NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Richard A. Chapman (on-site at Menlo Park) Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/1/72	5/31/74	☐ Contract ☒ Grant ☐ Intramural	Federal Cost: \$32,000 (72)	

TASK / PROJECT DESCRIPTION AND REPORTS

In the formation of silicon carbide from rice hulls, research has shown that an iron oxide catalyst increases the yield of silicon carbide. The kinetics of the reaction and the parameters that effect the rate of silicon carbide formation are being investigated. The products are unusually high surface area materials which are not available on an industrial basis, indicating that a market is available for the products. Successful task completion will provide a process to help alleviate a specialized solid waste problem.

RESEARCH TASK/PROJECT TITLE To Explore the Fundamental Nature of Polyblends that Can be Made from Plastic Wastes found in Refuse		FY 1973 TASK NUMBER 24AIN 14	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☒ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR Donald R. Paul, Department of Chemical Engineering The University of Texas at Austin Austin, Texas 78712		NAME, TITLE, AND ADDRESS OF EPA ☐ PROJECT DIRECTOR ☒ PROJECT OFFICER Daniel F. Bender Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 8/1/70	EST. COMP. DATE 7/31/73	METHOD OF SUPPORT ☐ Contract ☒ Grant ☐ Intramural	FUNDING INFORMATION Federal Cost: \$25,404 (72)

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to determine the physical characteristics of polyblends that can be made from the most common plastics found in refuse in the actual occurring proportions. Polyblends without additives have been studied and several publications are in various stages of preparation. Polyblends with additives which increase physical strength, have been found and a study to optimize additive conditions and to determine their strengths is currently proposed as the third year effort.

RESEARCH TASK/PROJECT TITLE Separation and Recovery Techniques on a Unit Process Basis at Pilot Plant Scale		FY 1973 TASK NUMBER 24AIN 15	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Robert Olexsey Solid Waste Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/30/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$140,000

TASK/PROJECT DESCRIPTION AND REPORTS

One task objective is to design, construct, and evaluate a pilot plant to accomplish automated sorting of municipal refuse on a dry basis. Emphasis is on adapting existing equipment and processes to refuse sorting rather than the development of new equipment specifically for refuse. Equipment has been selected, procured, and will be installed on a unit basis. The second task objective is to design, construct and evaluate a pilot plant to study the scale-up potential of various processes for the conversion of cellulosic wastes to useable products. Fermentation techniques, chemical conversion processes and other similar techniques, will be investigated for processing specialized solid wastes. This limited technological development is a necessary approach currently being studied as a method to induce a greater degree of resource recovery from municipal solid waste.

MONITORING QUALITY ASSURANCE 1H1327

OUTPUT: Development and identification of an Agency-wide standardization and quality control program to assure that environmental data produced by federal, state, and local agencies are compatible, accurate and legally defensible. Program effort will be to select, evaluate, standardize, and publish procedures and methods for sampling, analyzing, and reporting data relative to environmental pollutants. In addition, this program will establish procedures for an determine the acceptability and equivalency of methods and instruments for field use.

PARAMETRIC SYSTEMS FOR WATER QUALITY MEASUREMENT

RESEARCH TASK/PROJECT TITLE State-of-the-Art Survey of Instrumental Measurement of Biochemical Oxygen Demand for Control Applications			FY 1973 TASK NUMBER 01AAD 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/73	EST. COMP. DATE 6/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The reduction of waste loads to receiving streams from municipal sewage treatment plants would greatly enhance the quality of these streams. Waste treatment plant processes and retention times can be controlled more efficiently if rapid determination of waste loads upon the plant and discharged waste loads to the receiving stream can be made. The objective of this survey, then is to determine if instrumentation or alternative methods for the rapid measurement of BOD (the recognized standard for waste load) is presently available. The literature survey includes papers obtained through: (1) a related inquiry by R. C. Kroner to the Analytical Methodology Information Center (AMIC); (2) Water Resources Abstracts; (3) recent environmental journals; and (4) bibliographic references of pertinent papers. The papers were all obtained through EPA library services. No direct, reasonably rapid, or reproducible instrumental technique for measuring the BOD was discovered in the literature. An alternative approach recommended by A. F. Gaudy utilizing the change in COD (Δ COD) across a treatment plant shows more promise. It is theorized that further work in this area could bring even more results. That is, effluent discharge in terms of Δ COD and actual treatment plant efficiencies. Collection of field data is necessary to verify and refine the method. Eventually an instrumental approach could be pursued by the selection and evaluation of suitable oxidants and sensors.

RESEARCH TASK/PROJECT TITLE Survey of Instrumentation for Biological Measurements			FY 1973 TASK NUMBER 01AAD 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 10/1/73	EST. COMP. DATE 6/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective is to acquire information on instrumentation for biological measurement for field application and considers two basic areas; instrumentation for evaluation and instrumentation requiring modification. The second may also require a sample preparation method to be developed prior to field application. Consequently, the instrumentation package will require more extensive development in comparison to instrumentation planned for evaluation only. The survey suggests the instrumental techniques most amenable for field monitoring. In view of program redirection, this state-of-the-art survey is being redirected in its original intent and is being incorporated into Task 01AAD 05.

Instruments are generally not designed for direct application to field investigations; however, the fluorometer is an exception. This instrument measures chlorophyll a. The photometer, with luciferin and luciferase which are the extract of the lightning bug, is employed for measuring total biomass and can be adapted to intermittent or continuous field application.

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RESEARCH TASK / PROJECT TITLE Evaluation of Optical Techniques for Biological Measurement			FY 1973 TASK NUMBER 01AAD 05
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/1/73	EST. COMP. DATE 6/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000

TASK / PROJECT DESCRIPTION AND REPORTS

The main objective is the evaluation of optical techniques such as fluorescence and luminescence for field measurement of biological indications of pollution; however, due to program redirection (see Task 01AAD 03), this task has been restricted to evaluating the fluorometer for application in field investigations. The evaluation will involve the determination of the selectivity of the technique employed. This can be done through careful scrutinization of the sample conditioning. Sample interference will also be investigated. This would entail studying the techniques for possible degradation of the sample reading due to such effects as turbidity and color. Long-term stability is usually a problem encountered with optical systems; this characteristic and temperature stability of the system will be analyzed.

RESEARCH TASK / PROJECT TITLE State-of-the-Art Survey on Specific Ion Electrodes Adaptable to Continuous Field Measurement			FY 1973 TASK NUMBER 01AAD 08
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/72	EST. COMP. DATE 6/1/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000

TASK / PROJECT DESCRIPTION AND REPORTS

A variety of specific ion electrodes have been developed primarily for short-term laboratory use. The survey objective is to determine design configurations that are available and adaptable to intermittent or continuous field applications for effluent monitoring. A survey of companies and study of papers dealing with the subject will be pursued, employing the various libraries and information centers available to EPA.

It is currently planned to document those sensors suitable for field application when the survey is completed and augment the most recent specifications for the integrated system with these parameters. A section of this document is closely interrelated with Task 24ALE 05.

RESEARCH TASK/PROJECT TITLE Adapt Specific Ion Electrodes to Field Instrumentation			FY 1973 TASK NUMBER 01AAD 09
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 11/1/72	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000

TASK/PROJECT DESCRIPTION AND REPORTS

This project has been redirected to perform field evaluation of the ammonia and cyanide monitoring systems recently developed by the Orion Company. It is intended to evaluate the sample conditioning functions for optimizing the sensor performance, and to also consider the possibilities of differential measurement techniques.

The monitors will be analyzed for construction detail, operating principles, and papers dealing with laboratory application reviewed. The monitors will be tested in the laboratory to verify background data and tested under field conditions.

RESEARCH TASK/PROJECT TITLE Performance and Design Evaluation of Turbidimeters for Field Application			FY 1973 TASK NUMBER 01AAD 10
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/73	EST. COMP. DATE 1/74	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$5,000

TASK/PROJECT DESCRIPTION AND REPORTS

Continuous measurement of turbidity and/or suspended solids has not been totally satisfactory for field applications. The objective is to evaluate several turbidimeters to determine preferred optic design for adaptation to continuous effluent monitoring and incorporate these findings in the latter editions of monitor specifications.

Several parametric systems employing various optical arrangements will be studied and evaluated under laboratory and field conditions. Linearity, optical drift, response to particle size, and color characteristics of the selected system will be observed and reported. Four turbidimeters employing different design concepts have been obtained for investigation. It is planned to acquire a variety of standards and background color for initial performance studies.

RESEARCH TASK / PROJECT TITLE		FY 1973 TASK NUMBER	
Pulse Techniques for Measurement of Dissolved Oxygen		01AAD 11	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION
6/15/72	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$5,000

TASK/PROJECT DESCRIPTION AND REPORTS

Field measurement of dissolved oxygen in continuous monitoring applications is affected by mechanical, chemical, and biological components adhering to the membrane. The objective of this project is to develop a system for measuring dissolved oxygen that will be independent of the contamination affects on the membrane based upon a concept originally suggested by H. Mancy. Digital computer techniques will be adapted to the design to provide a periodic reduction potential and the sensor current integrated and converted to indicate dissolved oxygen concentrations. Several sensors have been acquired and several are being modified to experimental work with the pending parametric system.

DATA HANDLING AND TRANSMISSION

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Application of Nimbus Satellite to Water Quality Data Transfer			09ADO 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
2/1/73	Continuing	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$5,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Several methods for transferring water quality data from a remote facility to a central station, have been explored, the most recent being application of the Nimbus satellite. The objective of the experiment was to accumulate data in two modes - hourly transmission via hard wired into a minicomputer and semidaily transmission to EPA through Lewis Research Center, NASA, via the Nimbus; analyze the data; and determine the feasibility of the overall approach.

The water quality data acquisition system (EPA specifications) was interfaced (EPA) into a transmitter (NASA) and a parallel input was made available to the Schneider telemetry system (EPA specifications). Twelve months of data has been accumulated for analysis. It is planned to document the operation, summarize the data, and noting the necessity for extending the System software program to automatically analyze other data originating from the NASA system (see Task 09ADO 06).

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Develop Data Reduction Program for Teletype System			09ADO 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
9/1/72	6/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$8,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this task is the reduction of data through the use of a program on the PDP-8/S computer for the comparison of EPA/NASA transmission modes described in Task 09ADO 05. The program was written in Pal III assembly language. Separate segments were written to: (1) load EPA data into memory in conjunction with the System II interface program; (2) load NASA data into memory from an ASCII coded paper tape; and (3) reduce and compare the data to determine transmission mode accuracy.

Tests simulations of the program have been completed. Present and future satellite data when transferred to ASCII coded tape of the proper format, can be reduced and compared to the System II data collected from telemetry facilities. A report will be available soon which describes the program. Simplified flow charts and complete program listings will be included.

RADIOCHEMICAL MEASUREMENTS

RESEARCH TASK/PROJECT TITLE Development and Testing of Analytical Radiochemical and Chemical Methods for Measuring Radionuclides Discharged at Nuclear Facilities			FY 1973 TASK NUMBER 24AAK 01
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Bernd Kahn, Radiochemistry & Nuclear Engineering Research Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/68	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$73,700

TASK/PROJECT DESCRIPTION AND REPORTS

Methods are tested and modified to determine the concentrations of radionuclides that are discharged at nuclear power stations and associated facilities. The procedures are developed in cooperation with standard-setting groups to assure that the methodology is applicable. Upon completion of the project, a laboratory manual of methods will be published for use by nuclear facility operators and regulatory agencies.

RESEARCH TASK/PROJECT TITLE Development and Testing of Methods for Measuring Radionuclides in the Environment at Extremely Low Concentrations			FY 1973 TASK NUMBER 24AAK 02
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER Bernd Kahn, Radiochemistry & Nuclear Engineering Research Lab NERC - Cincinnati, Ohio 45268	
BEGINNING DATE 7/1/68	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$30,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of this project is to measure population radiation exposures from nuclear facility operations due to discharges of radionuclides. Radionuclides, many of which are below normally detectable levels, are to be measured in samples of air, food, biota and drinking water. Techniques include analysis of very large samples and/or application of extremely sensitive detection equipment. Upon completion of the project, instruction manuals and test reports will be published for utilization by EPA, AEC, and state agencies concerned with measurement of population radiation exposures.

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QUALITY CONTROL PROGRAM FOR CHEMICAL, BIOLOGICAL AND
MICROBIOLOGICAL ANALYSIS

RESEARCH TASK / PROJECT TITLE Reference Sample Program for Quality Control of Chemical, Biological and Microbiological Methods		FY 1973 TASK NUMBER 24ACX 01-07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John A. Winter Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE 1/70	EST. COMP. DATE Continuing	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$50,000

TASK / PROJECT DESCRIPTION AND REPORTS

To establish and maintain quality control within environmental laboratories, an independent source of samples is needed for each constituent analyzed. The reference sample program provides these samples on a continuing basis as requested. The samples are used for independent checks on reagents, instruments or techniques, for training analysts and for laboratory certification. Reference samples are available for Nutrient Analyses (nitrate-N, ammonia-N, Kjeldahl-N, orthophosphate and total phosphorus), Demand Analyses (BOD, COD, TOC), Mineral Analyses (sodium, potassium, calcium, magnesium sulfate, chloride, alkalinity/acidity, total hardness, total dissolved solids, pH, and specific conductance), Nitrilotriacetic Acid (4 levels), Trace Metals (aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, selenium, and zinc, 3 levels), Mercury (organic and inorganic, 3 levels), and Linear Alkylate Sulfonate (LAS), a surfactant reference standard.

The reference samples are prepared as concentrates in sealed glass ampuls, which when diluted to volume with distilled or natural water, according to instruction, produce samples with the concentration of constituents ranging from minimum detectable levels to those found in heavily polluted streams.

VALIDATION OF METHODS FOR CHEMICAL, BIOLOGICAL AND MICROBIOLOGICAL ANALYSIS

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Method Study 4, Automated Methods of Analyses			24AEL 04	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John A. Winter Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/71	6/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The Analytical Quality Control Laboratory is responsible for assuring the legal defensibility of data from water and waste analyses in EPA. This objective is attained by selection and evaluation of the best methodology in formal interlaboratory method studies. EPA laboratories and any other interested laboratories are invited to participate. The only requirements for participation in these studies are: (1) strict adherence to instructions for preparation of samples; (2) use only of the specific method of analysis; and (3) reporting back of the data within a set period of time. Formal EPA reports are prepared for each method study. Laboratories are identified only by a confidential code number. Method Study 4, Automated Methods for Minerals and Nutrients, was conducted to yield a valid measure of the performance of EPA and other laboratories for ammonia nitrogen, nitrate nitrogen, Kjeldahl nitrogen, organic nitrogen, orthophosphate, total phosphorus, alkalinity, chloride, and sulfate, as measured on the Technicon Autoanalyzer.

The data were collected and are being evaluated in a formal EPA report. The data will be used to provide precision and accuracy measures for EPA's manual: Methods for Chemical Analysis of Water and Wastes.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Method Study on Organic Pesticides in Water and Wastewater			24AEL 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John A. Winter Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
6/70	6/73	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The Analytical Quality Control Laboratory is responsible for assuring the legal defensibility of data from water and waste analyses in EPA. This objective is attained by selection and evaluation of the best methodology in formal interlaboratory method studies. EPA laboratories and any other interested laboratories are invited to participate. The only requirements for participation in these studies are: (1) strict adherence to instructions for preparation of samples; (2) use only of the specific method of analysis; and (3) reporting back of the data within a set period of time. Formal EPA reports are prepared for each method study. Laboratories are identified only by a confidential code number. Method Study 5, Organic Pesticides in Water, was conducted to measure the performance of EPA laboratories and others in analyses for chlorinated hydrocarbon pesticides present at the low nanogram/liter levels found in our natural waters.

The data were collected and after evaluation were used to provide precision and accuracy data in the EPA Manual: Methods for Organic Pesticides in Water and Wastewater, 1971, and are being prepared in a formal EPA report.

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RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Method Study 7, Trace Metals in Water and Wastewater			24AEL 06	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John A. Winter Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/71	12/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$25,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The Analytical Quality Control Laboratory is responsible for assuring the legal defensibility of data from water and waste analyses in EPA. This objective is attained by selection and evaluation of the best methodology in formal interlaboratory method studies. EPA laboratories and any other interested laboratories are invited to participate. The only requirements for participation in these studies are: (1) strict adherence to instructions for preparation of samples; (2) use only of the specific method of analysis; and (3) reporting back of the data within a set period of time. Formal EPA reports are prepared for each method study. Laboratories are identified only by a confidential code number. Method Study 7, Trace Metals, was conducted to yield valid measurements of the performance of EPA laboratories and others for the elements: aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, selenium, and zinc. Concentrations were set at typical natural and polluted levels. All analyses were by atomic absorption spectrophotometry except for arsenic and selenium, which were done by the silver diethyldithiocarbamate and diaminobenzidine methods.

The data were collected and are being evaluated for inclusion in a formal EPA report and for use as precision and accuracy statements in the EPA manual: Methods for Chemical Analysis of Water and Wastes.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Method Study 8, Total Mercury in Water			24AEL 07	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR			NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER John A. Winter Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268	
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT	FUNDING INFORMATION	
7/71	6/74	☐ Contract ☐ Grant ☒ Intramural	Federal Cost: \$25,000	

TASK/PROJECT DESCRIPTION AND REPORTS

The Analytical Quality Control Laboratory is responsible for assuring the legal defensibility of data from water and waste analyses in EPA. This objective is attained by selection and evaluation of the best methodology in formal interlaboratory method studies. EPA laboratories and any other interested laboratories are invited to participate. The only requirements for participation in these studies are: (1) strict adherence to instructions for preparation of samples; (2) use only of the specific method of analysis; and (3) reporting back of the data within a set period of time. Formal EPA reports are prepared for each method study. Laboratories are identified only by a confidential code number. The sudden awareness of the world to the omnipresence of mercury in the environment demanded many answers to questions on disposition of mercury in streams and stream bottoms. To assist EPA in its need for mercury methodology, M&PE conducted ASTM/EPA Joint Method Study 8, Mercury in Water, to measure the precision of EPA, ASTM and other laboratories in analyzing for both organic and inorganic mercury using a single selected cold vapor method. The data were collected and are being evaluated first to support acceptance by the ASTM D-19 Committee at its January 1973 meeting; second, to prepare a formal EPA report; and thirdly, to prepare precision and accuracy statements for the EPA manual: Methods for Chemical Analysis of Water and Wastes.

WATER SAMPLE COLLECTION AND CONDITIONING SYSTEMS

RESEARCH TASK/PROJECT TITLE Design and Install an Automatic Cleaning System to Evaluate Affect of Sample Degradation			FY 1973 TASK NUMBER 24ALE 02	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 9/72	EST. COMP. DATE 6/73	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$4,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Biological growth on the inner pipe surfaces of pumping systems for automatic instrumentation can change the water sample (especially dissolved oxygen) prior to analysis. The change in sample increases as the internal surface area of the pipeline increases, the water velocity decreases and the water temperature increases with seasonal conditions. The object of this investigation is to determine the feasibility of automatic chlorination for eliminating growth within the system and to determine the optimum concentration of chlorine and frequency of chlorination at a specific location during warm weather when biological activity is at a maximum. The approach is to adapt a small commercially available chlorinator (vacuum operated) to an instrumentation pumping system. The system is designed to automatically chlorinate the pipelines at a preset concentration, for short intervals, periodically throughout the day. The optimum concentration and frequency of chlorination is to be determined in this study. The mechanical operation of the system is to be evaluated.

An evaluation of an automatic chlorination system for eliminating biological growth in pumping system for automatic instrumentation was tested under selected conditions and a report discussing the performance is in preparation.

RESEARCH TASK/PROJECT TITLE Evaluation of Intake Design Variations and an Assortment of Motor/Pump Assemblies to Provide Minimal Degradation			FY 1973 TASK NUMBER 24ALE 03	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL ☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		NAME, TITLE, AND ADDRESS OF EPA ☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE 7/1/70	EST. COMP. DATE 6/30/74	METHOD OF SUPPORT ☐ Contract ☐ Grant ☒ Intramural	FUNDING INFORMATION Federal Cost: \$10,000	

TASK/PROJECT DESCRIPTION AND REPORTS

Intake systems for automatic instrumentation have presented problems of sample degradation related to design configuration and mechanical problems, the most significant being pump failure. The objective of this study is to evaluate systems for sample change (overall and across specific parts of the system) and to evaluate pumps (commercially available, modified and prototypes) in an effort to locate a most suitable unit for supplying a continuous undegraded water sample to automatic instrumentation with minimal downtime. The approach is to evaluate systems for sample change by comparing parameters (mainly dissolved oxygen) at the source to readings at specific locations as the sample travels to the instrument. This identifies components contributing most significantly to change and allows a rational decision regarding redesign of that part of the system or elimination of the cause with chlorination or some other method. An evaluation of pumps against specifications for size, weight, capacity, sample degradation and durability is also required. Current progress includes the evaluation of two pumping systems on different rivers and exposed to different flow and pollutional load characteristics. One provided basic data on an operational system. The other evaluation was performed to obtain data on a system which was serviced more frequently in an effort to retain minimal sample degradation. To-date three different pumps have been evaluated and areas where improvement is needed was determined. Several documents have been prepared on the design and evaluation of intake systems and pumps. A continuing effort is planned for obtaining the most ideal intake systems for automatic instrumentation.

RESEARCH TASK/PROJECT TITLE			FY 1973 TASK NUMBER	
Auxiliary Flow Cell for Intermittent Field Measurements			24ALE 05	
NAME, TITLE, AND ADDRESS OF EXTRAMURAL		NAME, TITLE, AND ADDRESS OF EPA		
☐ PROJECT DIRECTOR ☐ PRINCIPAL INVESTIGATOR		☒ PROJECT DIRECTOR ☐ PROJECT OFFICER A. F. Mentink Analytical Quality Control Lab NERC-Cincinnati, Ohio 45268		
BEGINNING DATE	EST. COMP. DATE	METHOD OF SUPPORT		FUNDING INFORMATION
7/1/70	7/73	☐ Contract ☐ Grant ☒ Intramural		Federal Cost: \$2,000

TASK/PROJECT DESCRIPTION AND REPORTS

The objective of the experimental auxiliary flow chamber, is to provide means for sample preparation so that oxygen decay and selected specific ion sensors can be investigated in field installations. The experimental oxygen decay measurement is generic, but is expected to be related to a specific source and exhibit an equivalent oxygen requirement by a source. Electrodes specific to a selected measurement require a medium with minimal interferences for proper operation.

The auxiliary flow cell is equipped with a control function, two storage vessels, heaters, aeration stirrers, recirculation pump, pH control, dissolved oxygen sensor, and selected specific ion electrodes. The sample is conditioned for the measurement chosen, given a continuous output.

It is planned to test this device in FY '73 under various environmental conditions. This task is closely coordinated with Task 01AAD 08.

APPENDIX A

EXTRAMURAL PROJECT DIRECTORS/PROJECT OFFICERS

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